AMERICAN JOURNAL OF ORTHODONTICS

OFFICIAL PUBLICATION OF
THE AMERICAN ASSOCIATION OF ORTHODONTISTS,
ITS COMPONENT SOCIETIES, AND
THE AMERICAN BOARD OF ORTHODONTICS

PUBLISHED BY THE C. V. MOSBY COMPANY, ST. LOUIS 3, U. S. A.

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Vol. 43 **OCTOBER, 1957** **No. 10**

Vol. 43. No. 10, October, 1957. American Journal of Orthodontics is published monthly by The C. V. Mosby Company, 3207 Washington Blvd., St. Louis 3, Mo. Subscription rates: United States and its Possessions $10.00, Students $5.00; Canada, Latin-America, and Spain $10.50, Students $5.50; Other Countries $11.00, Students $6.00. Single copies $1.75 postpaid. Entered as Second-class matter, July 14, 1915, at the Post Office at St. Louis, Missouri, under the Act of March 3, 1879. Printed in the U. S. A.

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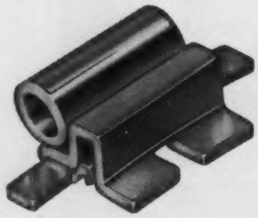

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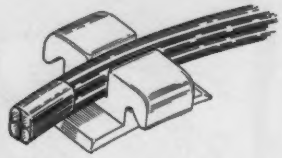

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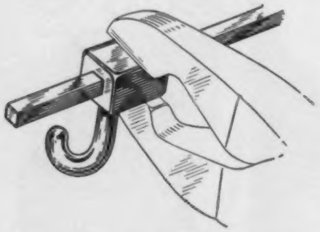

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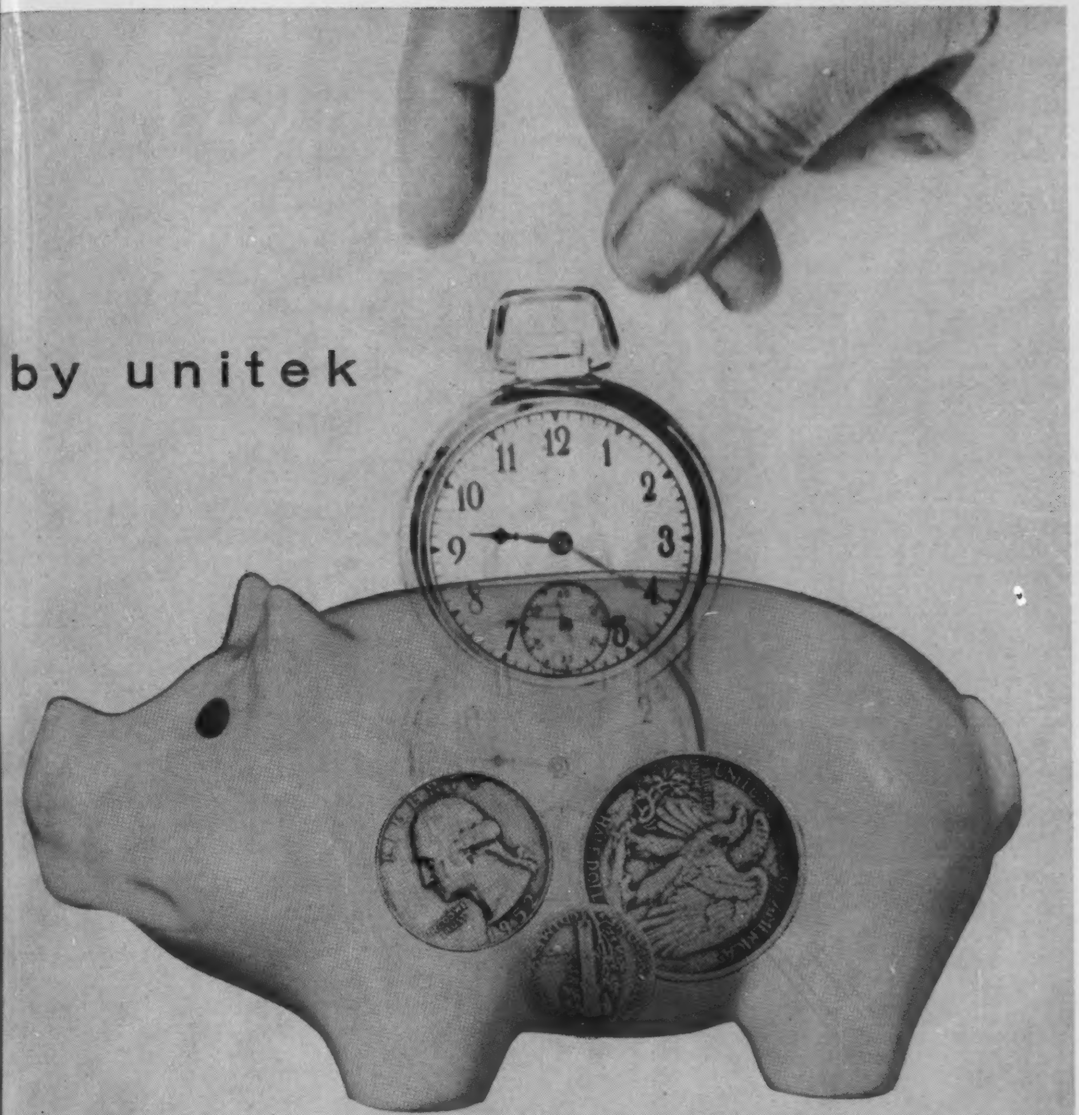

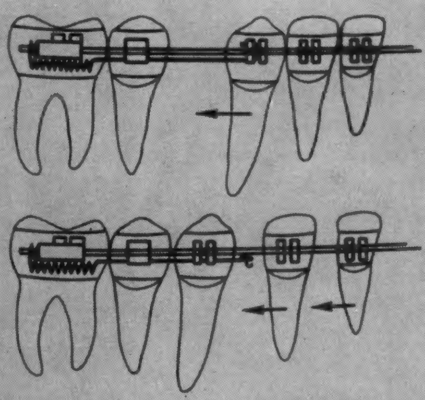

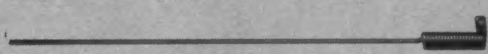

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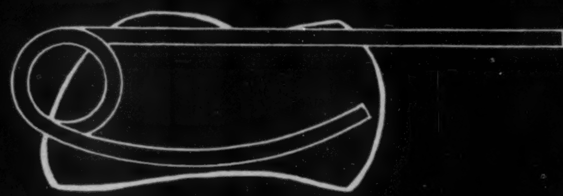

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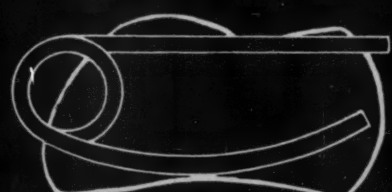

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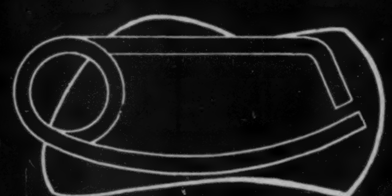

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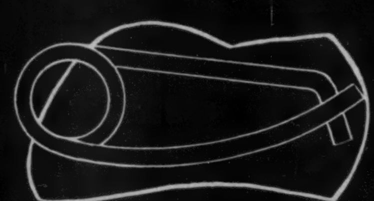

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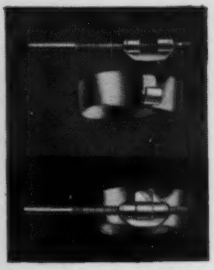

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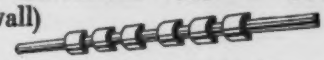

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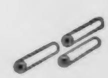

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Original Articles

AIMS AND METHODS OF TREATMENT IN THE DECIDUOUS DENTITION

Edward A. Cheney, D.D.S., M.S., Lansing, Mich.

SINCE the turn of the century orthodontic clinicians and writers have discussed the advantages of treatment during the deciduous dentition. At this time, I want to point out several objectives of treatment in the deciduous dentition and review their contribution to the total growth and development of the dentofacial complex. I am interested in dealing with deciduous dentition therapy only when such therapy serves to promote and establish favorable growth sequences in the permanent teeth. For the orthodontist who is attempting to enlarge and extend his service to his community, there is great opportunity along this line. Growth is rigorous at this stage of development. Change through growth is rapid. Small amounts of orthodontic therapy and supervision can contribute extensively to the development of healthy and functional dentitions. In addition, it is an excellent time to guide and direct dentofacial development.

One of the most important objectives of orthodontic therapy during the period of the deciduous dentition lies in the management of the local, or extrinsic, factors which modify growth at this stage. Other considerations may be more dramatic. Yet, attention to the modifying local factors is most essential if we intend to provide an acceptable orthodontic service. These influences can unbalance the sequence of normal individual occlusal development. In addition, they can intensify and complicate the deep-seated malocclusions.

Presented at the annual meeting of the American Association of Orthodontists, New Orleans, Louisiana, May, 1957.

Several of the extrinsic factors are highly influential during the deciduous dentition. One is the occlusal interferences which result in functional shifts of the mandible. The functional shifts of the mandible result in traumatic cross-bites and inlockings. In the deciduous dentition cross-bites and inlockings act to modify dentofacial growth in an undesirable manner. As growth proceeds, the influences are passed on to the permanent dentition. In the permanent dentition, one or more of several destructive changes can take place. There can be destruction of the teeth and their supporting structures. The alveolar bone can distribute abnormally in support of malposed teeth. In the more extreme cases dentofacial asymmetry occurs. In addition, the functional shifts of the mandible may result in temporomandibular joint disturbances for many persons. All of you have seen these results and have treated cases influenced by them. Many of you have noted that, as the functional cross-bites and inlockings proceed from the deciduous to the mixed and permanent dentitions, the resulting malocclusions become intensified and more deep-seated. In general, the irregularity becomes more difficult to correct. Often, in the permanent dentition, it is impossible to remove all the modification and damage which follows the influence of the functional shift of the mandible. Fig. 1 illustrates the progressive influence of lateral functional shifts of the mandible upon the growing dentition. Fig. 1, *A* shows two casts taken of a 4-year-old girl, who was one of our research children at the University of Michigan. The cast on the left shows the occlusion as observed by the school nurse. The girl's mother had asked the nurse to explain the significance of the "odd" biting relationship. According to the mother, the girl had been "biting" in this relationship for about ten days. The school nurse referred the case to our attention. After examination of the closure patterns, it was apparent that the patient could effect the more desirable occlusion shown by the casts on the right. Yet, she continued to shift abnormally into contact occlusion as shown by the casts on the left. After some questioning, we learned that she had fallen against a door two weeks previous to the examination. In the fall, she struck the maxillary right deciduous canine. The canine was slightly mobile. She said that when she closed her mouth "straight up" she "hit" the tooth and it "hurt." To solve this problem, she had learned to shift the mandible to the right and into the cross-bite occlusion shown here. Treatment consisted of retraining the patient to occlude in centric contact. The correction required an explanation at the 4-year-old level, myofunctional therapy, and daily checking by the school nurse for two weeks.

Fig. 1, *B* shows the casts of a girl 8½ years of age. The cast on the left was taken prior to treatment. As we study the width of the dental arches in this cast, it is apparent that the maxillary dental arch is not as wide as the mandibular dental arch. Here the mandible has shifted to the left and into a cross-bite, as shown by the midline comparison. The shift apparently began in the deciduous dentition with the first molars conforming to the pattern. The cast on the right shows the correction. Six months of maxillary arch expansion was required to permit the mandible to close vertically from rest position into a normal centric contact. Fig. 1, *C* reveals the face and the closure patterns of a

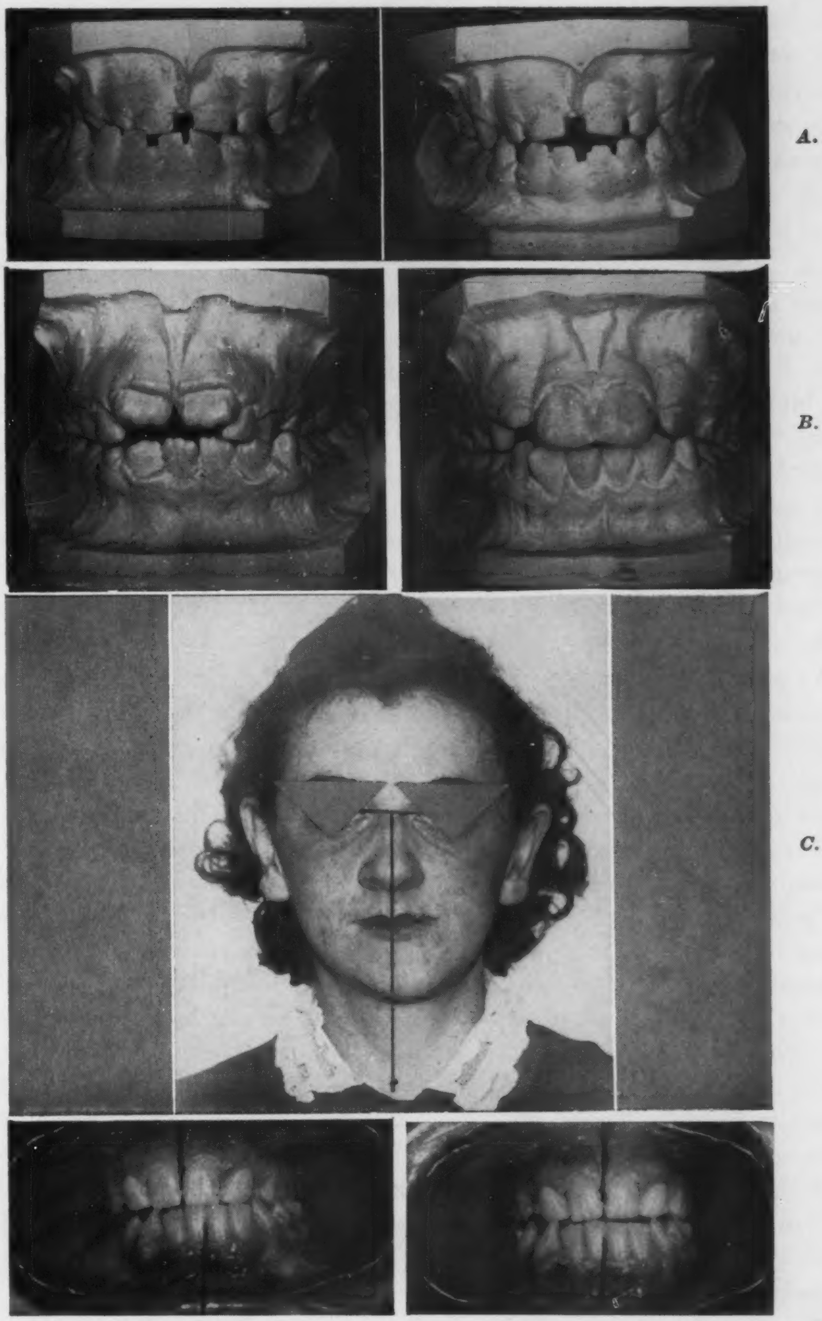
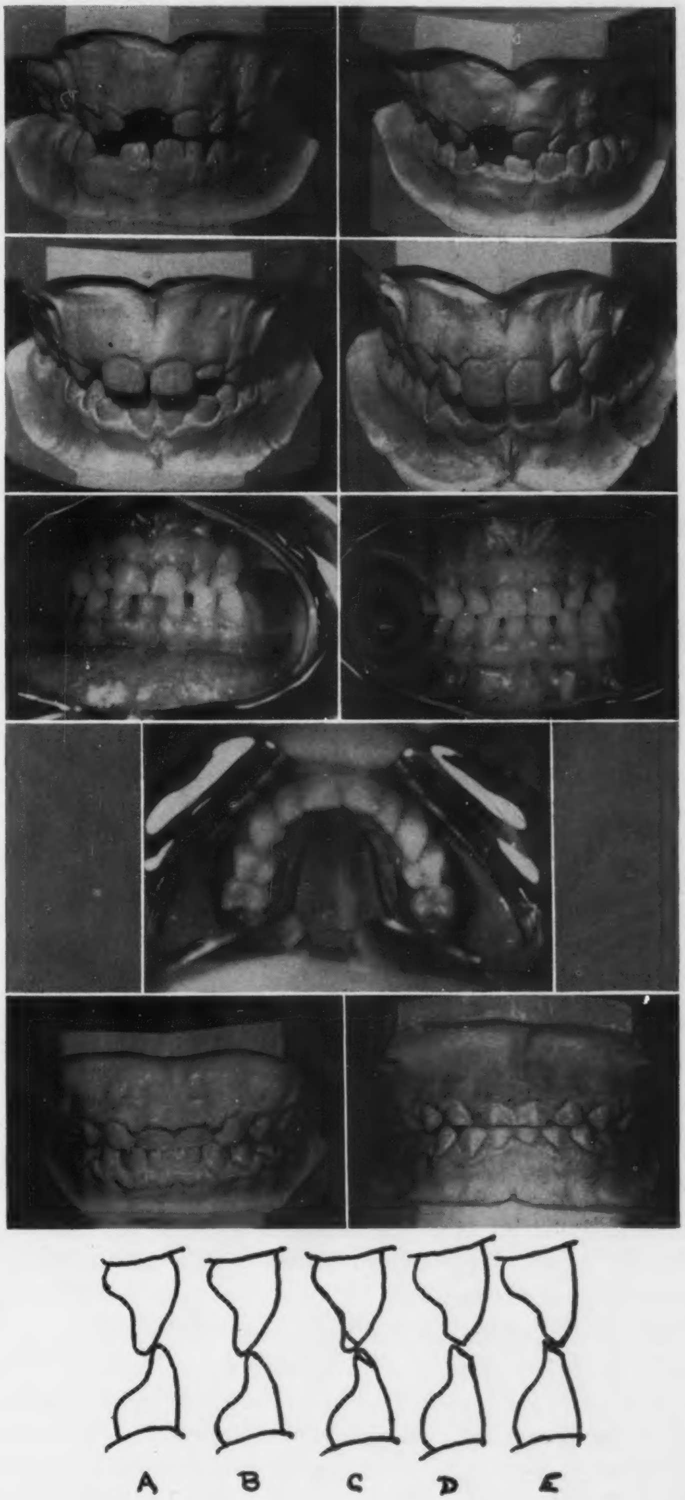


Fig. 1.—Photographs illustrating the progressive influence of lateral functional shifts of the mandible upon the growing dentition. *A*, Posterior cross-bite in the deciduous dentition. *B*, Posterior cross-bite in the transition dentition. *C*, Posterior cross-bite in the permanent dentition.

young adult at 21 years of age. On the facial photograph a line has been drawn through the pupil of each eye. A nearly perpendicular line has been dropped to the lower face. As shown in the photograph, the chin is to the right of the nearly perpendicular line. The facial asymmetry is evident. The lower left photograph shows the occlusion of the patient when she was asked to close her mouth with the teeth together. The lower right photograph reveals a different occlusion. It is the occlusion that results when the patient closes her mouth directly vertical from rest position. To effect centric contact occlusion, the patient had to be trained to relax the musculature and close to a first premature contact. Otherwise, she would have followed her acquired closure pattern of shifting to the right and into cross-bite as shown by the lower left photograph. In the lower right illustration, it is easy to see that the maxillary and mandibular dental arches are equal in width. The lower incisors tilt to the patient's left. They bite end-to-end with the maxillary incisors. The midlines are in the same vertical plane. Although not shown, the lateral chin shift was much less. It appeared that arch expansion and minor dental modification would result in a nearly perfect occlusion. This therapy was applied. However, it took twenty-one months of treatment and considerable occlusal equilibration to effect a reasonable change. Powerful elastic traction over a long period only partially retrained the masticatory muscles to follow a more vertical closure pattern. The facial asymmetry was reduced, but it was not eliminated completely.

As we consider the three cases just presented, I recognize that every orthodontist has observed similar problems in his own practice. I have shown these cases to emphasize that the postponement of treatment of a functional malocclusion serves to intensify the trauma and asymmetry to the growing structures. The alveolar bone follows the teeth in their abnormal development. As growth proceeds, the abnormality becomes more extensive and deep-seated. Later, treatment is less satisfactory. Often, permanent retention becomes a necessity after basal and alveolar bone growth has slowed or stopped. In addition, it is of interest to remember, relative to the cases shown here, that the deciduous dentition treatment took only thirty minutes of talk and habit training. The mixed dentition required six months with a lingual arch and minor occlusal equilibration. The permanent dentition change required twenty-one months of complicated appliance therapy and extensive occlusal balancing. Yet, in the latter the results were far less desirable from every point of view. For these reasons, the functional cross-bites and inlockings should be corrected as early as possible in the developing dentition. Treatment of these conditions in the deciduous dentition is highly recommended. During this stage of development, the appliancing is simple, the treatment is of short duration, and the results are extremely effective.

There are various methods of dealing with the cross-bites and inlockings which result from functional shifts of the mandible in the deciduous dentition. All of these methods aim at removing the occlusal factors which cause the mandible to shift abnormally. In some cases, occlusal grinding is sufficient to make the change. Fig. 2, *A* illustrates a case of this type. The upper casts were



A.

B.

C.

Fig. 2.—Photographs illustrating several methods of correcting functional shifts of the mandible in the deciduous dentition. *A*, The result of posterior occlusal grinding. *B*, The result of posterior arch expansion. *C*, The result of anterior incisal grinding.

taken when the patient was 6 years of age. The patient showed a different closure pattern each time she was asked to "close." The upper casts illustrate these variations. They were taken at the same time. As we compare the midlines of the upper models, we can see that this girl closes to the right, then to the left. She does not follow a balanced vertical closure pattern. However, after the occlusal surfaces of the deciduous molars were equilibrated with a mounted stone, the mandible moved immediately into the occlusion shown in the lower left cast. The lower casts were taken at 8 and 12 years respectively. Following the equilibration, we instructed the patient in myofunctional exercises to aid in establishing a desirable closure pattern.

As we study methods of removing lateral mandibular shifts during closure, we note that in some children the grinding of teeth is not sufficient to overcome the occlusal irregularities which cause the shift. Fig. 2, *B* shows a case of this type. Here, the correction required arch expansion. A W-typed expansion arch was used. The treatment continued for three months. In this case, the nature and extent of arch expansion is of interest. As one looks at the occlusal view in the lower photograph, it is apparent that the patient's left buccal segment is closer to the midline, or median raphi, than the segment on the right. Examination of the upper left photograph reveals that the cross-bite is on the side of the dental arch constriction. At first glance, it is easy to assume that a repositioning of the upper and lower left posterior deciduous teeth to establish correct buccolingual occlusion would be sufficient. However, this is not the indicated treatment. Other considerations are involved. The upper left illustration in Fig. 2, *B* reveals that the lower midline between the incisors is to the left of the upper midline. Also, the left mandibular shift has resulted in a cross-bite relationship of the left lateral incisor and canine. In contrast, when this patient relaxed the mandible to rest position, it shifted to the right. At rest position, the midlines between upper and lower incisors were in the same vertical plane and the left canines opposed each other in an end-to-end relationship. From this position, it was evident that bilateral arch expansion was needed to correct the left cross-bite. It was necessary to widen the maxillary dental arch to enable the mandible to close directly vertical and into a normal centric contact. The maxillary dental arch was expanded. The upper right photograph in Fig. 2, *B* shows the result. The incisor midlines coincide. All canines are in correct labiolingual relationship. A balanced occlusal relationship is seen. No change was made in the lower dental arch. Minor occlusal adjustments were made following the arch expansion.

As we continue to examine the functional shifts of the mandible due to occlusal interferences, we note that these shifts can be made in any direction. Some are lateral, some are anterior, some are vertical, and a few seem to be of a backward or posterior nature. In all cases the correction is directed to modify the dental irregularity and permit the mandible to move normally into occlusion. To make these changes, various types of therapy are used, according to the nature of the irregularity. Anterior functional shifts of the mandible resulting

in incisor cross-bites are often corrected with an inclined plane. During function the plane forces the mandible to shift posteriorly. The maxillary incisors are directed to the labial side. In equal-sized jaws and balanced skeletal relationships the correction is rapid. In most cases, several days or weeks are sufficient to reduce the irregularity. The upper left photograph in Fig. 2, *C* shows an anterior cross-bite in a child 4 years of age. To make the correction, inclined planes were ground on the incisal edges of the upper and lower teeth. The lower photograph in Fig. 2, *C* is a schematic drawing illustrating the diagnostic and treatment procedures. Step *A* shows the occlusion at the time of the original examination. Step *B* reveals the incisor occlusion when the patient closes easily from rest to first occlusal contact. Here the mandible has not shifted forward to accentuate the cross-bite, as shown at *A*. Step *C* illustrates the inclines which were prepared on the incisal edges. The upper incline was on the lingual side; the lower incline was on the labial side. The inclines were extended so that, with closure from rest to first contact (as at *B*), the labial incline of the lower contacted the lingual incline of the upper. This relationship is shown in step *D*. The patient's mother was instructed to teach the patient to close the mouth, as in step *D*, and to have the child engage in alternate contractions and relaxation of the facial muscles. We asked the mother to have the patient bite hard for five counts, relax for three counts, but not to "take her teeth apart" during the exercise. She did this twenty-five consecutive times for four periods daily. In two weeks the correction at step *E* was recorded and is shown by the right cast in Fig. 2, *C*.

Fig. 3.—Photographs showing an incisor cross-bite which disappeared with the exfoliation of deciduous teeth. Treatment was not indicated.

As we continue to consider the correction of cross-bites and inlockings in the deciduous dentition, it is necessary to remember that some of these conditions do not warrant attention at this stage of development. In general, deciduous irregularities with no influence on the long-time growth and development are not treated. A case illustrating this point is shown in Fig. 3. The two casts shown here were taken of the same child. The cast on the left was taken at 4½ years of age; the cast on the right shows the dentition at 8½ years of age. After appraising the malocclusion shown in the deciduous dentition, it was evident that treatment was not indicated. From rest to contact occlusion, the patient closed vertically. No functional shift took place. The midlines of

the upper and lower dental arches coincided. The canines were not involved. The right upper deciduous incisor occluded to the labial side. The left incisor occluded in lingual relationship with its opponent. We concluded that with the exfoliation of deciduous teeth the irregularity would disappear. As shown by the cast on the right, the malocclusion was self-correcting. The consideration applied in this case should be given to all anterior and posterior cross-bites and inlockings in the deciduous dentition. If there is a functional mandibular shift associated with the malocclusion, we treat to remove the shift. If there is no functional shift of the mandible in connection with the dental irregularity, immediate treatment of cross-bites and inlockings is not indicated. In all probability, as illustrated here, the irregularity will disappear with the exfoliation of deciduous teeth. The succeeding permanent teeth will erupt into correct occlusion.

There are other local factors which act to modify the deciduous dentition sufficiently to influence the growth of the permanent teeth. Oral habits and the premature loss of deciduous molars are two of these factors. Time does not permit a discussion of their influence upon the developing dentition. However, I wish to emphasize that we must give close attention to the influence of these factors as well as the occlusal shifts during the period of the deciduous dentition.

At this time I should like to propose a second important treatment objective for the deciduous dentition. This objective can be described as adjusting the deciduous dental arches upon their supporting apical bases to establish balanced occlusal relationships. The treatment requirements in this regard are more extensive than those previously discussed. Until now, in this discussion, we have been talking about the removal of local factors in balanced dentofacial structures. By balanced dentofacial structures, I mean those cases where the upper and lower jaws are equal in size, are in good relationship one to the other, and there is adequate room for the teeth to erupt into good occlusion without the aid of treatment. In these cases, the removal of local influences is sufficient to permit a satisfactory occlusal development. As all of us know, however, most of the patients who come to our offices do not have balanced dentofacial structures. On the contrary, as we apply our various diagnostic techniques and observational procedures we note dentofacial variations of one kind or another. The mandible may be smaller and posterior to the maxilla. The mandible may be large and carry the teeth supported in it anterior to the maxillary teeth. Or the facial bones may not be large enough to support the teeth in good alignment. There are many combinations of these and other dentofacial irregularities. Some are extreme and we are limited in what we can do to correct them. On the other hand, many dentofacial variations are borderline in nature. We deal with them on a more reasonable basis. In my opinion, these are the problems which warrant consideration relative to early treatment and supervision in the deciduous dentition. When proper occlusal balance can be established at this stage of development, there is good opportunity in the borderline deep-seated malocclusions for subsequent growth and development to follow through to an acceptable permanent dentition. On the other hand, those problems which are

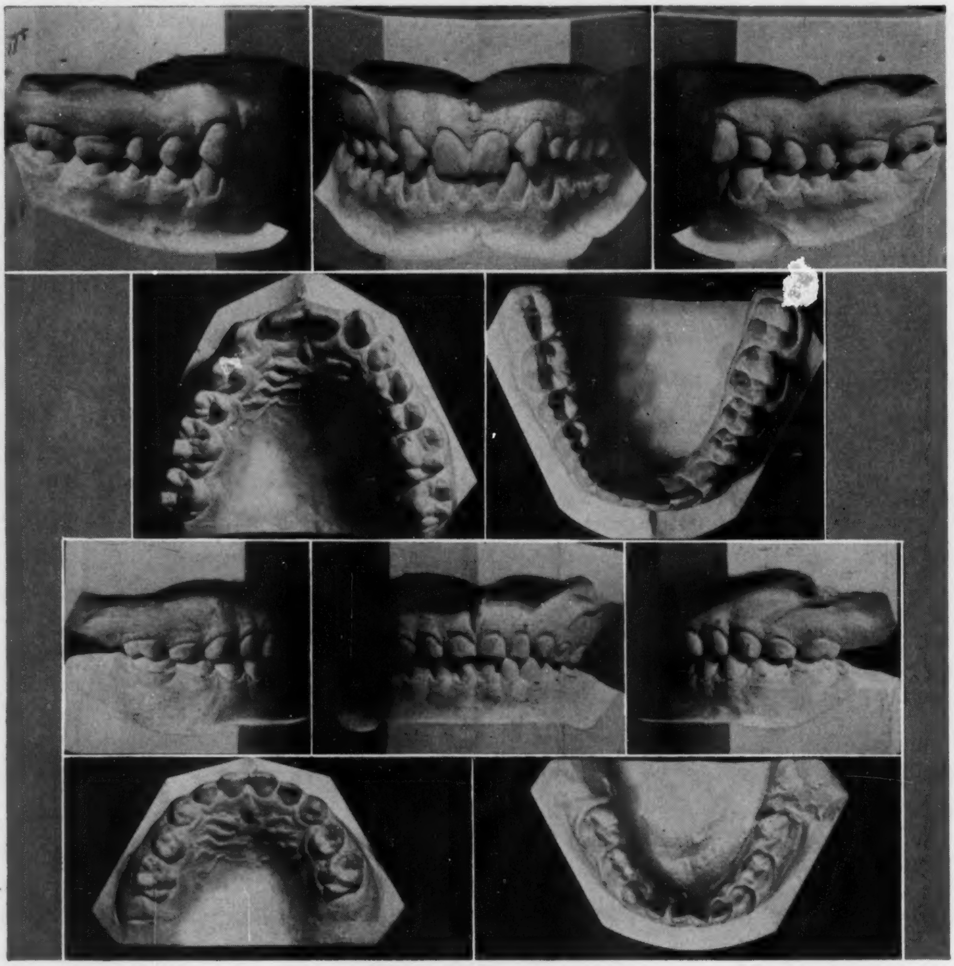
deferred to a later stage of dentofacial growth become more deep seated. Often they are difficult to treat, and require more appliancing. In addition, they lack the inherent stability of a dentition which has been directed into a proper occlusion. For example, observe the problem illustrated by the case in Fig. 4. Fig. 4, *A* shows the casts of a boy at 17 years of age. He has a bilateral Angle Class II malocclusion. The maxillary lateral incisors are congenitally missing. On the maxillary right side the teeth are in good alignment. There is contact from the central incisor to the molars. On the left, the maxillary first molar shows a one-half cusp Class II relationship. The deciduous canine is retained. The permanent canine has rotated and tipped infra-labially. The overbite is shallow.

How often have you looked at an early adult malocclusion like this one and asked yourself, "How did this occur?" This is the situation in regard to many patients whom we examine. In the early adult dentition it is difficult to reconstruct accurately the developmental background of the patient. Often, the occlusal relationships are not in keeping with the relationships shown by their skeletal bases. We can only conjecture about the nature of the problem with which we are dealing. Here, however, the situation is different. This is the final cast of a case taken from the research series of the University of Michigan Elementary School Growth Center. Fortunately, we can backtrack on the developmental changes and acquire additional information. The casts of this boy at 6 years of age are shown in Fig. 4, *B*. The first permanent molars have not yet erupted. The deciduous molars are in Class I relationship. There is spacing of anterior teeth. The overbite is shallow. As we study this photograph and think back to the casts of the permanent dentition, several facts are evident. The deciduous dentition shows an excellent balanced neutroclusion. In contrast, the permanent dentition is in Class II malocclusion. Apparently, the absence of the maxillary permanent lateral incisors permitted the maxillary buccal segments to shift forward. Perhaps the forces of occlusion hastened this change. In any event, a change occurred. The transition from a normal deciduous dentition to a Class II malocclusion took place over a period of years.

Fig. 4, *C* shows four stages in the dental development of this boy. The upper casts are of the deciduous dentition just reviewed. The second casts were taken two years later, at 8 years of age. All first permanent molars are in occlusion. The upper and lower central incisors have erupted. The deciduous molars are in neutroclusion. The first permanent molars are in a typical mixed-dentition end-to-end relationship. There is a shallow overbite. The anterior spacing still exists. The third casts were taken at 12 years of age. The dentition is slow in developing. On the right the first molars are still in end-to-end relationship. However, the maxillary molar has begun to move mesially. The canine has already migrated into the lateral incisor space, and the premolars are following. On the left, the upper second deciduous molar is still present, as is the lower one. The first premolar is erupting into an end-to-end relationship with its opponent. The maxillary upper left first molar is shifting mesially. The lower casts were taken at 17 years of age. I discussed them previously.

No matter what one may think about this case, it is evident that there was a gradual shift of the maxillary dental arch upon its apical base. The change took nearly ten years. You may be satisfied with the result shown here, or you may prefer to modify the malocclusion in one way or another. If you open the lateral incisor spaces for bridgework, considerable treatment will be required.

A.



B.

Fig. 4.—Photographs of the casts of a boy whose dentition changed through growth as a result of congenital absence of maxillary incisors. *A*, The permanent dentition. *B*, The deciduous dentition. *C*, Side views of casts of four stages of the dental development.

(Fig. 4, C on opposite page.)

On the other hand, if you decide to leave the incisors and canines in their present relationship, it is necessary to compromise with our concept of ideal dental alignment. In either event, you are forced to assume conditions which could have been prevented by early management of this dentition. In my opinion, a minimum of early treatment and supervision would have maintained the molars

in neutroclusion and directed the premolars and canines into a desirable alignment. These procedures would have required only an anticipation of the developmental problems to come and the proper timing of appliance therapy.

The early interceptive treatment possibilities as demonstrated by this case are applicable in many situations. Fig. 5 shows a dedicuous malocclusion which responded to early management and supervision. Fig. 5, *A* reveals the nature of the occlusion in the deciduous dentition. The patient is 4 years of age. In the closed-bite relationship he has an Angle Class II malocclusion. The mandib-

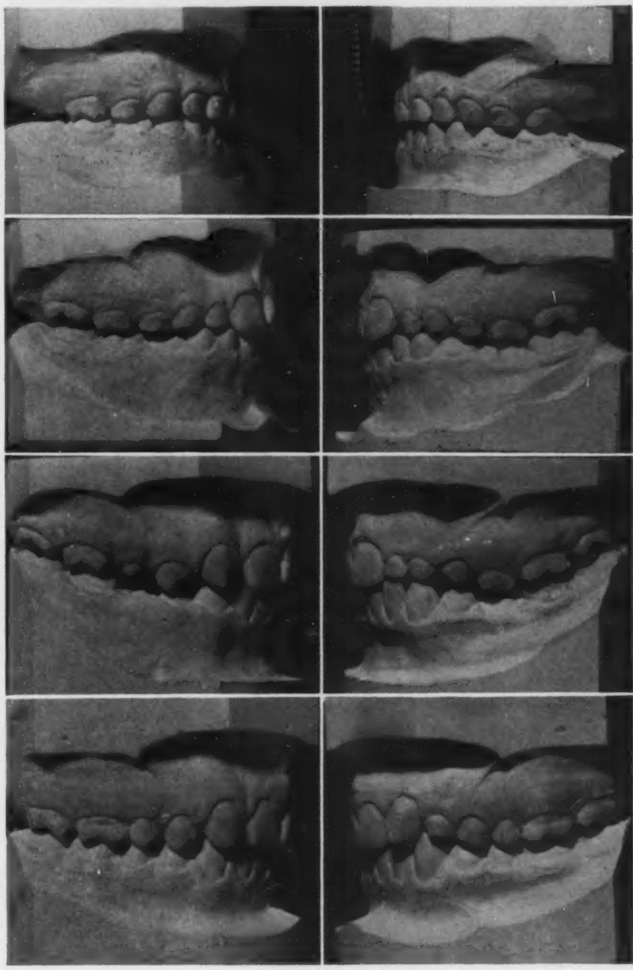


Fig. 4, *C*.—*(For legend, see opposite page.)*

ular right deciduous molars occlude completely lingual to the maxillary deciduous molars. The maxillary incisors are slightly protruded. There is a deep and impinging overbite, as well as a decided overjet. The occlusal views show wide, well-developed dental arches and massive alveolar ridges. However, the occlusion of these casts does not represent the entire nature of the case. At rest, the mandible wandered forward so that the mesiobuccal cusps of the second molars occluded nearly end-to-end. The overbite and overjet were reduced. The case

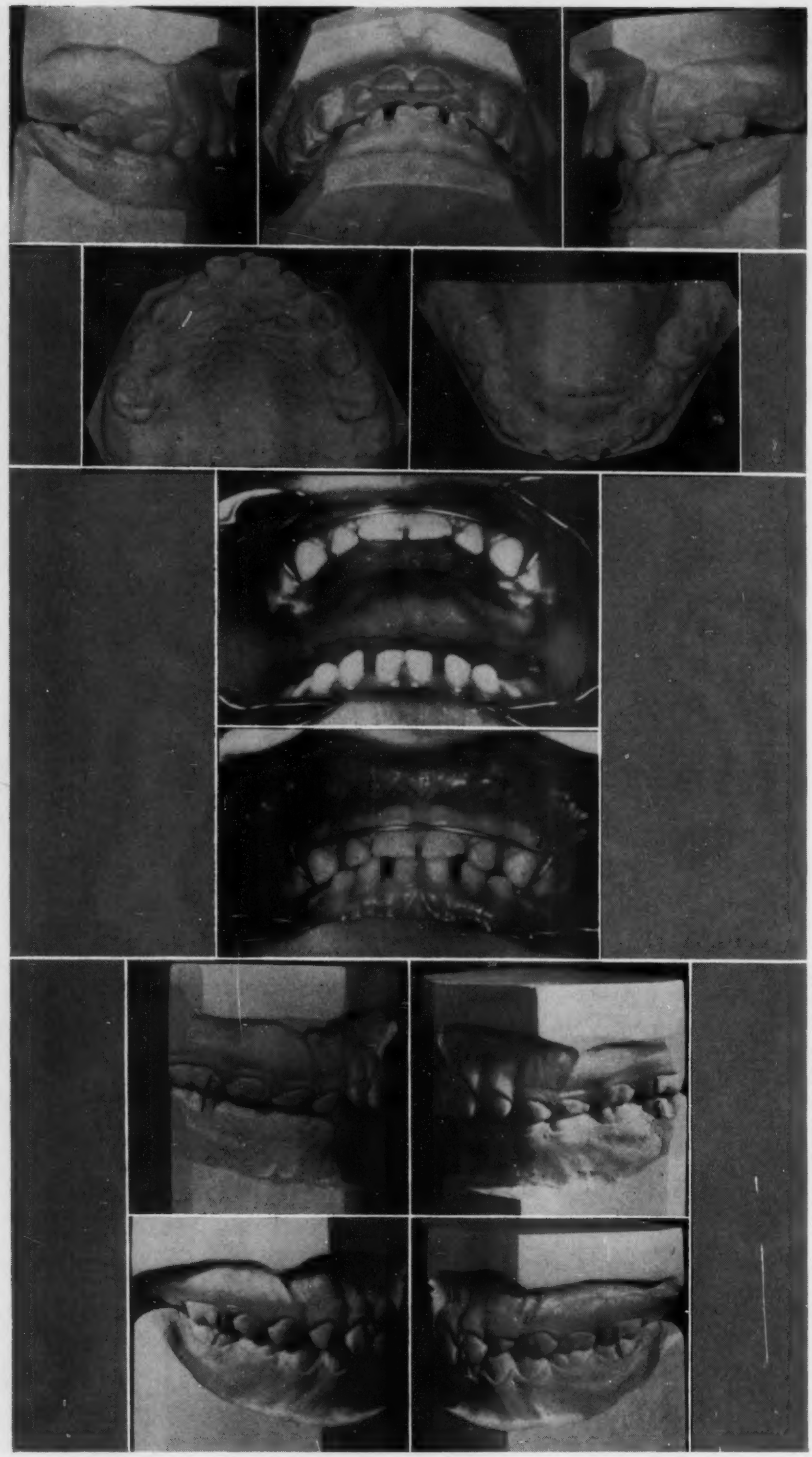

A.
B.
C.

Fig. 5.—Photographs illustrating the treatment of a deciduous Class II malocclusion. *A*, The casts before treatment. *B*, The Hawley appliance. *C*, Casts taken before and after cervical traction therapy.

was diagnosed as a borderline distoclusion exaggerated by a posterior and vertical functional shift. During closure the mandible shifted posteriorly to the patient's left and into the deep impinging overbite shown here.

The first objective in treatment was to reduce the extent of the functional shift. A maxillary Hawley appliance with an anterior bite plane was used. It is shown in Fig. 5, *B*. It has the usual labial wire and retentive clasps. A detailed appraisal of this illustration reveals that the bite plane has a moderate incline. The incline was incorporated into the appliance to aid in habit modification and muscle training. In theory, an incline is not necessary when opening the bite to facilitate the movement of the mandible to a position of centric contact. The patient should respond to a flat plane which opens the bite to rest position. However, some children acquire habit patterns which are difficult to evaluate. They do not always respond to a flat bite plane. To assist in training the mandible to overcome any undesirable habit pattern, an incline is incorporated into the palatal splint. As the patient bites hard on the incline, during mastication, the lower incisors slide forward up the incline and the mandible is forced to follow. In this way, the incline acts as a traction splint and serves to direct the mandible into a more favorable closure pattern. After a few weeks the incline can be reduced, or removed, and the patient's mandible moves into its true centric position.

The result of the bite plane therapy in this case is shown in Fig. 5, *C*. The upper casts were taken following the use of the Hawley appliance, when the patient was 6 years of age. They reveal a borderline Class II molar relationship. The overbite and overjet are reduced. The mandible closes directly to the occlusion shown here. During the treatment the mandible shifted forward. The posterior, lateral, and vertical mandibular shift disappeared. However, the one-half cusp bilateral Class II occlusal relationship still existed. The overbite continued to be deep and slightly impinging in nature. It is apparent that although much of the distoclusion was corrected, the malocclusion still retained its Class II characteristics. To adjust the occlusion further, cervical traction was initiated. The patient used the appliance each night for a period of several months. The lower casts show the results of this treatment. The cervical traction therapy served to establish a Class I molar articulation on both sides of the dentition. The overbite and overjet are reduced. The overbite is deep, but no longer impinging. In this case, the removal of local factors was not sufficient to establish a satisfactory occlusion. It was necessary to adjust the dental arches upon their apical bases in order to establish a balanced occlusal relationship.

A mesioclusion which reacted in a similar manner is shown in Fig. 6. Fig. 6, *A* shows the face and anterior cross-bite of a boy, aged 5 years 3 months. In the closed-bite relationship he has a cross-bite of the anterior teeth. The molars occlude in an Angle Class III malocclusion. From rest position to the contact occlusion, as shown here, there was a slight forward mandibular shift. The facial photographs reveal a husky, well-developed face. The maxilla and mandible are large and well developed. A detailed appraisal of the dentofacial complex revealed a borderline mandibular prognathism. However, the

lower incisors showed considerable spacing. The maxillary incisors were tipped to the lingual side. Treatment to reposition the mandible and correct the cross-bite was indicated. A lower Hawley appliance with a steep incline was selected to attempt the correction. The wire framework and waxed-up appliance, before processing, is shown in Fig. 6, *B*. The wire framework included occlusal rests, a labial section, and strong first deciduous molar clasps. The inclined plane was carried out over the labial incisal edges of the lower teeth. The patient used the

A.

B.

C.

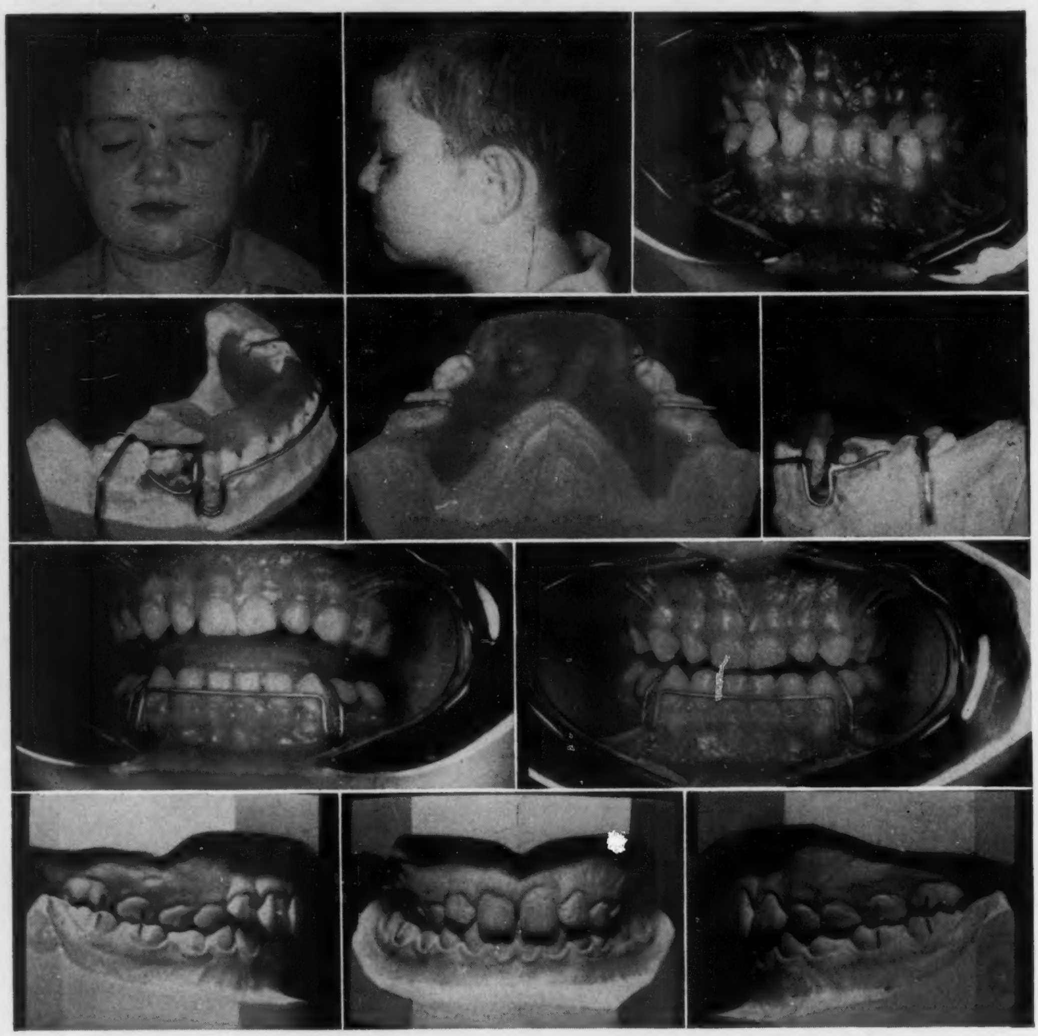


Fig. 6.—Photographs illustrating the treatment of a deciduous Class III malocclusion. *A*, The face and anterior cross-bite. *B*, The appliance used. *C*, The occlusion following treatment.

appliance at all times. He removed it only to brush his teeth. As the upper incisors functioned against the incline, they moved to the labial. The forces of mastication against the incline forced the mandible to its most posterior position of centric contact. In addition, the lower incisors were tipped lingually with the

labial wire. To facilitate lingual tipping of lower incisors, the acrylic was trimmed *lingual* to the four lower incisors and *distal* to the lower canines. The acrylic was not trimmed lingual to the lower canines. This contact—that is, the acrylic against the lingual surface of the lower canines—served to prevent the appliance from shifting forward when labial wire pressure was applied to the incisors. In this case, the labial wire did not contact the labial aspect of the canines. When pressure was applied to the lower incisors, they tipped lingually. As the incisor spacing closed, the distal aspect of the lateral incisor crowns moved against the mesial aspect of the deciduous canine crowns. The canines were forced to the distal aspect and into contact with the deciduous molars. If you look closely at the wire framework in these pictures you can see that the wire coming over the occlusion passes occlusalward to the mesial approximal margins of the first deciduous molars. The canines can move distally below the wire.

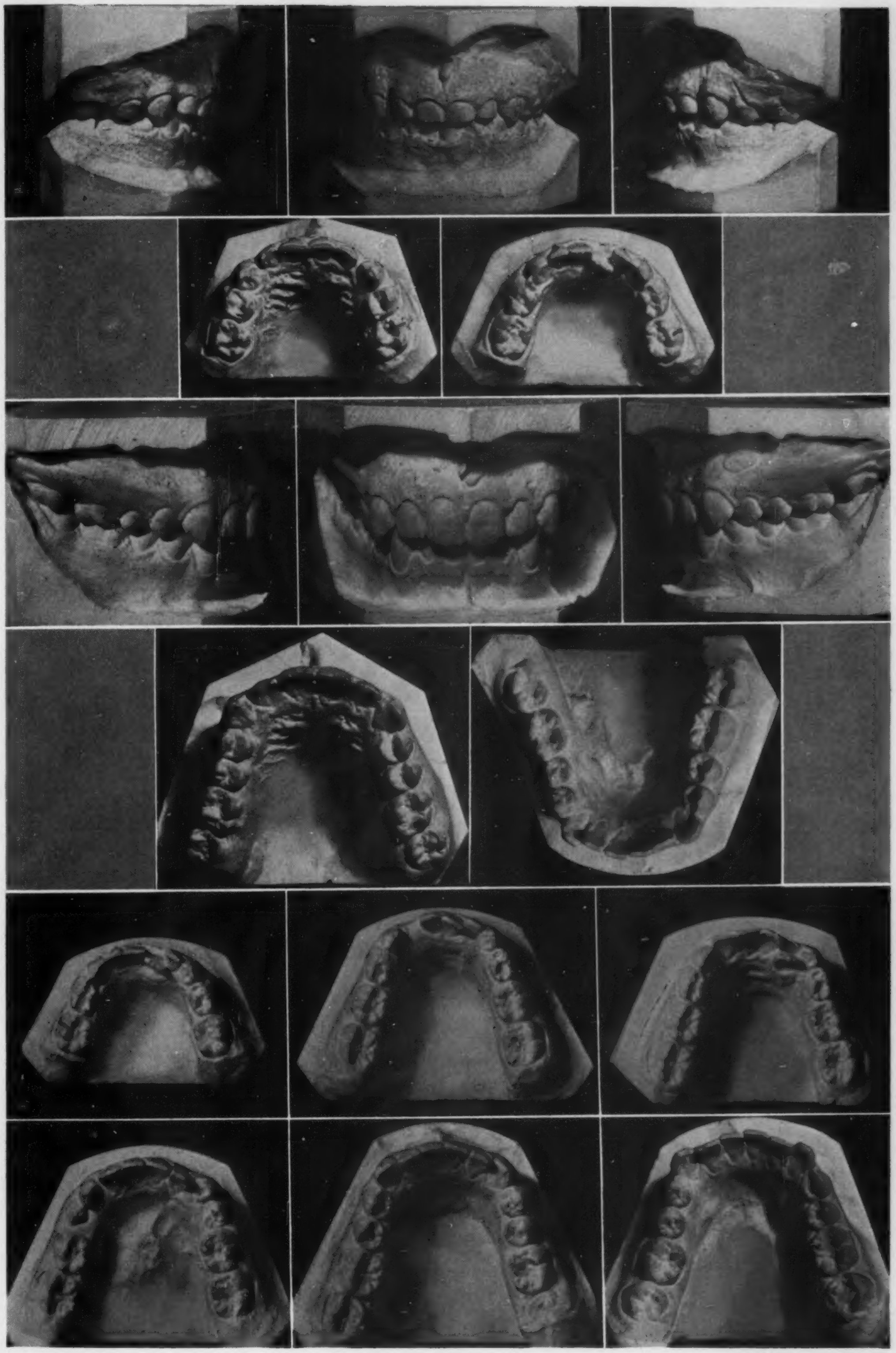
I have corrected many borderline Class III anterior cross-bites in a short time with a lower Hawley incline. For two reasons, however, this one failed. These reasons are important to anyone who intends to work with the developmental problems of the deciduous dentition. First of all, I overlooked the extent of root resorption of the deciduous incisors. Incisor root resorption was well advanced in this boy. The action of the labial wire against the teeth loosened them. It accelerated their exfoliation. After four weeks of treatment they became very mobile. In this condition they could not be relied upon to participate in the retentive stage of treatment. Incisor stability is important in the correction and retention of anterior cross-bites superimposed upon borderline mandibular prognathism. However, the second oversight was of greater significance. It involved the appraisal of mandibular size and relationship to other facial parts. Earlier in the discussion of this case, I noted that the patient's mandible was slightly larger than the maxilla. The diagnostic measurements had indicated the presence of the relationship. I failed to give this information its rightful consideration. Probably all of us do this from time to time. It is easy to make this error in the deciduous dentition. The teeth are small. The bones of the face are only partially developed. Dentofacial variation and irregularity are in smaller proportions than those of the permanent dentition. Yet, as many researchers have pointed out, the general pattern of dentofacial development has been determined at this stage of growth. The facts are present. As at any age, they require close appraisal and use. Here, the tipping of incisor teeth and the shifting of the mandible to a correct centric position were not sufficient to correct the cross-bite. It was necessary to retreat the case with fixed appliances and Class III intermaxillary elastic traction. With this action, we shifted the upper and lower dental arches upon their apical bases to establish a balanced occlusion. Casts taken three years later are shown in Fig. 6, *C*. The molar occlusion reflects the apical base mandibular prognathism.

There is another aspect of adjustment of the deciduous dental arches upon their supporting apical bases which warrants our consideration. Earlier in this discussion I pointed out the value of expanding the upper dental arch in the

deciduous dentition to remove occlusal factors which result in functional shifts of the mandible during closure. In these cases, arch expansion directed desirable dental growth and development and established occlusal balance.

Now I should like to give attention to expanding the deciduous dental arches to facilitate a better alignment of the permanent teeth. The greatest concern in this regard centers around lower anterior crowding. These are a number of ideas about this subject. Our treatment experiences lead us to discredit arch expansion as a useful phase of orthodontic therapy. For a long time there has been much discussion about the collapse of expanded dental arches. Most of us will agree that arch expansion is not reasonable in cases which have moderate or extensive amounts of incisor crowding. On the other hand, we do know that alveolar bone deposits in support of the growing teeth. To some extent it conforms to the position of the teeth on the apical base. It is reasonable to think that in some of the so-called borderline deficiency cases, deciduous dental arch expansion may be of value. It could direct tooth position and subsequent alveolar bone growth. Several writers have urged attention to this aspect of treatment.

To assist in appraising the value of deciduous arch expansion to aid the final alignment of permanent incisors, I should like to show dental development in several series of casts taken from the University of Michigan Elementary School. Fig. 7, *A* shows the front and side views of the casts of the deciduous dentition of one of our children. The casts were taken when the patient was 6 years of age. The lower permanent incisors are just erupting. There is spacing mesial to the deciduous canines. No other spacing exists. The deciduous molars are in neutroclusion. The overbite is moderate. Fig. 7, *B* shows the casts of the permanent teeth of the same girl. They were taken at 17 years 5 months of age. The overbite remains moderate. The molars are in neutroclusion. No spacing is evident. The canines are definitely in labioversion. As we study these casts, several facts are evident. Both dental arches are slightly deficient. The deficiency is not great, but it is present. The canines did not have sufficient room to erupt into ideal alignment. For some orthodontists, the alignment shown here would be satisfactory. For others, it would be unacceptable. In any event, here is a case in which we can ask ourselves: "Would expansion of the deciduous dental arches have provided space for ideal alignment of the permanent dentition?" Part of the answer becomes evident as we examine the details of growth and development shown in Fig. 7, *C*. Six stages of development of the lower dental arch are shown in Fig. 7, *C*. The upper left view shows the deciduous dentition with lower permanent central incisors two-fifths erupted. They overlap. The upper center cast was taken one year later. It reveals that the incisors are four-fifths erupted and the overlapping has nearly disappeared. The upper right cast was taken two years later. Here, the lower permanent lateral incisors are crowded. One is to the labial side and one is to the lingual. Two years later, as shown by the cast on the lower left, the crowding disappeared. In the lower center cast the alignment has improved. Unfortunately, the canines have



A.

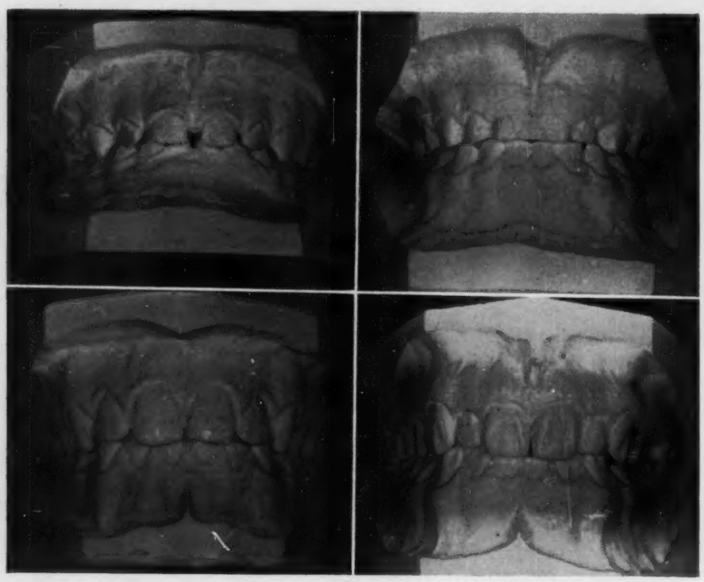
B.

C.

Fig. 7.—Photographs of casts illustrating the dental development of a girl from the deciduous dentition (*A*) to the permanent dentition (*B*). *C*, Six stages of development of the lower dental arch.

not completely erupted. Six years later, as shown by the last cast on the lower right, the canines were forced to the labial side. Apparently, this change resulted with the final eruptive thrust of these teeth.

To appraise this case further, we did a mixed-dentition evaluation. The upper center cast of 1936 was used for this purpose. A modified Wylie-Ballard technique was applied. The lower four incisor widths were measured and totaled. The total was applied to a scale to determine the expected widths of the unerupted canines and premolars. The results are of interest. In the lower arch, the molar-to-lateral-incisor distance was estimated to be approximately 2 mm. short for the permanent teeth. In the upper arch the estimated deficiency was 1.5 mm. on both sides. These calculations include allowance for the overlapping of lower incisors as seen in the cast taken in 1936. On the basis of this



A. *B.*

Fig. 8.—Photographs showing variation in dental development of two patients relative to deciduous incisor spacing. *A*, The casts of the upper deciduous dentition show considerable spacing. *B*, The casts of the upper deciduous dentition show no spacing, while the lower permanent casts of the same patient show good incisor alignment.

information, the end result shown in the 1945 cast is better than expected. The reason is that the permanent canines and premolars required less space than was expected. The estimate indicated a need for 23.4 mm. on each side. The actual mesiodistal width of the canines and premolars on each side was 20.8 mm. The mixed-dentition analysis overestimated the need for space. In explanation, it should be noted that this overestimating is expected. The mixed-dentition analysis was developed to overestimate the need of space. In this manner, the estimate becomes more realistic; it tries to allow for individual variations in tooth size. The only trouble is that in many cases human variation is too great to evaluate in a set of tables. Even so, the mixed-dentition calculations are a useful diagnostic aid, when correctly interpreted.

Several other developmental changes in these models are of interest. From 1933 to 1936 the lower deciduous intercanine width *increased* 3.5 mm. From 1938 to 1945 the total arch length decrease was 6.0 mm. Yet, the arch width decrease at the first molars during the same period was only 2.0 mm. Apparently, the incisors moved distally around the arch to occupy some of the mesiodistal arch length not used by the premolars and canines. In addition, when the first permanent molars shifted mesially, the reduction in arch *width* was small compared to the 6 mm. reduction in arch *length*. Very little converging of molars occurred as they shifted forward. This fact implies good arch width, which is true. The casts all show wide trapezoidal arches. If these arches had been narrow and tapering, the crowding would have been much more severe.

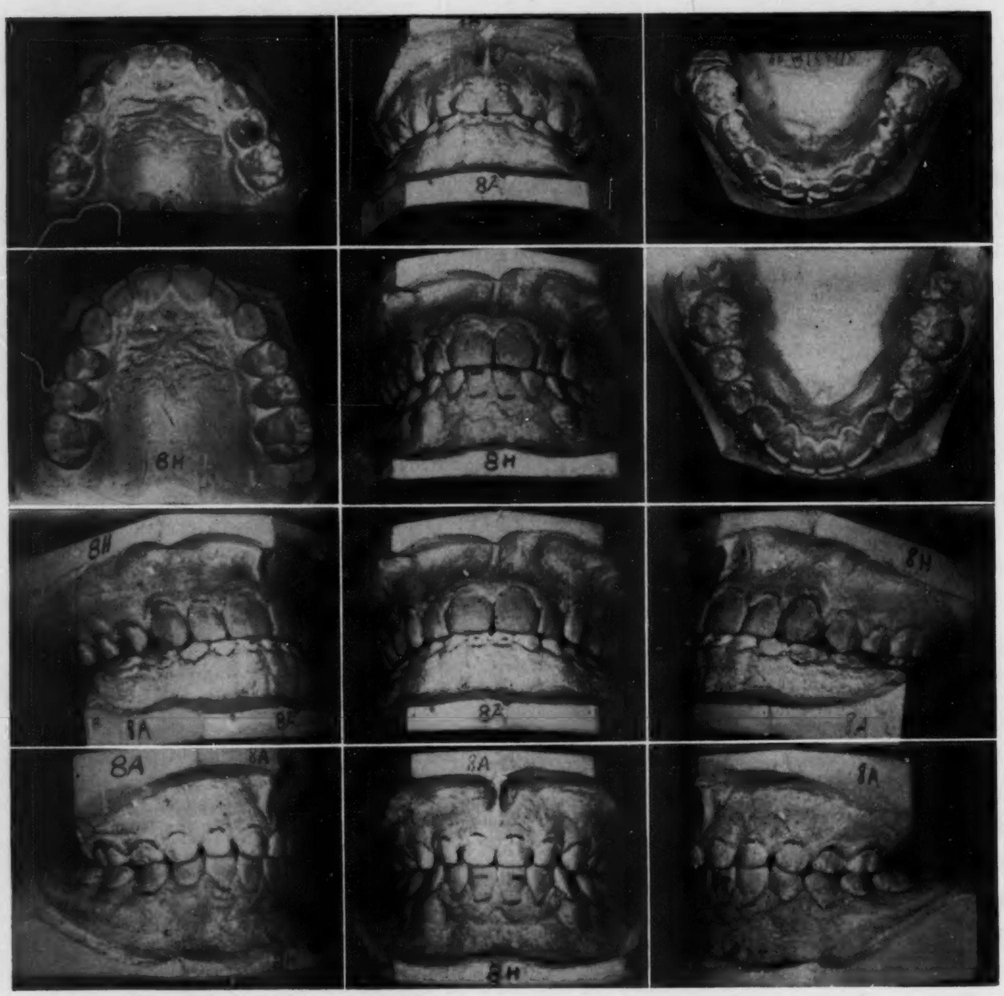
As we continue to consider the value of expanding deciduous dental arches to aid the alignment of permanent teeth, several other considerations should be noted. For example, each person is different. Fig. 8 shows the deciduous and permanent dentitions of two other patients. The upper and lower casts in Fig. 8, *A* left were taken of the same boy. The upper and lower casts in Fig. 8, *B* were taken of a girl. In Fig. 8, *A* the deciduous dentition shows considerable spacing. As the deciduous teeth exfoliated, the permanent teeth erupted and good dental alignment resulted. This is expected. In general, we have assumed that excessive spacing in the deciduous dentition indicates good alignment in the permanent dentition. Now look at the casts in Fig. 8, *B*. Close examination reveals that there is no spacing in the deciduous dentition. Yet, the permanent teeth in this same girl show a satisfactory alignment. One reason is that the maxillary lateral incisors are relatively smaller than the other adjacent teeth. In any event, the balance between tooth size and arch support is just right to permit this exception to occur. In general, we have not expected good permanent dental alignment when the deciduous teeth show no spacing. Yet, it occurs about 10 per cent of the time in the University of Michigan Elementary School series.

On the other hand, certain relationships of the deciduous dentition to its permanent successor appear to be constant and expected. One of these relationships is demonstrated in Fig. 9. Fig. 9, *A* shows the deciduous and permanent dentitions of still another patient. The permanent casts were taken eight years after the deciduous records. In Fig. 9, *A* we see the occlusal views of the upper and lower arches, as well as the casts in occlusion. Both permanent and deciduous arches show a similar arch form. There is some spacing between the maxillary deciduous incisors. There is very little spacing in the mandibular deciduous incisors. The relationship which I wish to demonstrate is shown in Fig. 9, *B*. Here, the maxillary deciduous arch has been occluded with the permanent mandibular arch. Also, the mandibular deciduous arch has been occluded with the maxillary permanent arch. As we study this demonstration, it is interesting to note the excellent manner in which the deciduous arch "fits" the opposing incisors, canines, and premolars of the permanent dental arch in the same person. This is not unusual. In all of the long University of Michigan

Elementary School series, the same comparison can be made. Almost without exception, the same close occlusal "fitting" can be demonstrated. It occurs in abnormal as well as normal occlusions.

We could look at many other cases showing the change from the deciduous to the permanent dentition. At this point, however, let me review the discussion about the *objective* of adjusting deciduous dental arches upon their supporting

A.



B.

Fig. 9.—Photographs showing the deciduous and permanent casts of the same individual. *A*, The occlusal and front views. *B*, The manner of occlusal "fitting" of the primary and permanent casts of the same individual.

apical bases to establish a balanced occlusion. With regard to deciduous arch expansion to aid permanent-incisor alignment, several facts are clear. To begin with, much of the early crowding of lower incisors is relieved by the movement of these teeth distally as the deciduous canines and molars exfoliate. I have

observed these changes again and again in the long series of the University of Michigan Elementary School studies. Arch expansion appears to be of little value in aiding this type of developmental change. Another fact has to do with the appraisal of the permanent-dentition needs during the period of the deciduous teeth. We may anticipate the general space requirements of the patient by studying his dental hereditary background. Still, the details of dental adjustment are the individual patient's special prerogative. Our available diagnostic aids for estimating these developmental adjustments are applied to the permanent teeth during the mixed dentition. We have to await their arrival before we can work with them. There appears to be little evidence at the time of the deciduous dentition to aid in deciding whether or not deciduous arch expansion will contribute to permanent incisor alignment. In fact, such evidence as is present points in the other direction. Judging from the preciseness of the occlusal "fitting" shown in Fig. 9, *B*, the ability of the deciduous dentoalveolar structures to adjust laterally through expansion is too limited for this expansion to be applied as a general procedure. Apparently, there is little or no modification of basal bones following closure of the symphysis of the mandible. In addition, the restricting factor of steep occlusal inclines found on most newly erupted molars, premolars, and canines must be considered. It is probably true that the unerupted permanent teeth will follow the expanding deciduous molars to some extent. Still, when the forces of occlusion are applied through the incline planes of newly erupted teeth, a new set of developmental factors takes over. All of us have observed dental arches in which the teeth have been modified by these forces.

On the other hand, as we look at the possibilities of adjusting the deciduous dental arches mesially or distally with regard to influencing the permanent dentition, the opportunities are more attractive. The maxilla and mandible are elongating anteroposteriorly through growth during the time of the deciduous dentition. There is more room for tooth movement in these directions. There is more flexibility and adaptation relative to cuspal interdigitation in both deciduous and permanent dentitions. After balanced deciduous dental relationships have been established, the forces of occlusion become a favorable factor. With the eruption of permanent teeth, intercuspal occlusal forces serve to resist dental changes in the borderline Class II and Class III skeletal relationships.

CONCLUSION

In conclusion, I wish to summarize the discussion in this article. In general, I have said that we ought to remove the influence of local factors when they are modifying dentofacial development in the deciduous dentition. In addition, I have stressed the value of establishing a balanced occlusion in borderline Class II and Class II apical base discrepancies at this stage of dental development. Finally, I have doubted the wisdom of expanding deciduous dental arches to favor permanent incisor alignment.

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LOCAL FACTORS IN MALOCCLUSIONS

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IT GOES without saying that every orthodontist is concerned about the causes of malocclusions. He is interested because he wants to prevent malocclusions, because he wants to administer treatment unhindered by damaging influences, and because he wants his treated cases to remain stable without disturbance by disrupting factors.

A casual survey of the dental literature suggests that the group of items commonly known as "local" factors in malocclusions occupied considerably more prominence some years ago than they do currently. One is inclined to guess that emphasis on local conditions and influences began to wane when studies of jaw growth and studies of the results of treatment led to the conclusion that the positions of the teeth seem to have little or no effect on the size of the bodies of the jaws. Despite the apparent de-emphasis on local factors in recent years, considerable progress has been made toward viewing these factors in better perspective within the total field of etiology.

Therefore, it seems appropriate in the first part of this discussion to summarize some of the prevailing attitudes toward the influences and conditions that have appeared for years on the traditional list of local factors. The second part of this presentation will suggest that the traditional list can be rearranged in one way to provide a more realistic check list. The third part will suggest rearrangement in another way to serve better the needs of the clinician.

CURRENT ATTITUDES TOWARD LOCAL FACTORS

1. *Local Conditions and Influences Frequently Damage the Occlusion, But Sometimes They Do Not.*—The fact that the local influences are nowadays called "factors" and not "causes" indicates realization that their consequences are sometimes uncertain. Only conditions or events that will always be followed by certain happenings can be called causes. When there is a cause-and-effect relationship there is a determinative, explanatory connection between events in the temporal series. Sometimes preceding and succeeding events are only coincidences. Often it is tempting to consider a coincidental relationship a cause-and-effect relationship.

An example of an event that may or may not be followed by damage is the early loss of a second deciduous molar. The adjacent first permanent molar

Presented at the annual meeting of the American Association of Orthodontists, May 13, 1957, New Orleans, Louisiana.

may not move mesially an appreciable amount if favorable occlusal forces, favorable axial inclinations, and late eruption of the second permanent molar combine to maintain the stability of the first molar.

In other circumstances, loss of a second deciduous molar may be followed by a serious loss of arch length as the first permanent molar moves mesially. Occasionally, mesial movement of the first molar occurs prior to its eruption, early resorption of the roots of the second deciduous molar permitting this undesirable movement.

2. *Local Factors May Vary in Severity From One Child to Another.*—Obvious examples of variations in degree are found among children with supernumerary teeth. One child may have a single, small, horizontally located maxillary midline supernumerary tooth that produces only a small alteration in the axial inclinations of the adjacent incisors. Another child may have a vertically located supernumerary tooth that seemingly causes rotation of one central incisor without disturbing the other. Another child may have a larger supernumerary tooth and show more dental irregularity with malpositions of both central and lateral incisors. Still another child with two large supernumerary teeth in the central incisor region and an adjacent supernumerary lateral incisor may have dental irregularity from canine to canine.

3. *Some Local Factors Can Be Readily Eliminated During the Development of the Occlusion So That the Remaining Natural Changes Can Largely Correct the Previous Disruption.*—Instances of properly timed removal of supernumerary teeth exemplify the spontaneous corrections that can occur in some situations. It should be obvious that not all the local handicaps can be eliminated easily or completely, and so total self-correction of an anomaly is not common.

4. *Local Factors Produce Different Effects in Different Persons or in Different Locations in the Same Person.*—The consequences of retained deciduous teeth offer easily observed examples of differing effects. Sometimes a retained deciduous tooth is displaced by its erupting permanent successor and sometimes the deciduous tooth deflects the erupting permanent tooth into malposition.

The effects of tongue-thrusting likewise vary. In two children with large tongues whose thrusting activities appear quite similar, one may have maxillary and mandibular anterior teeth tipped labially, whereas the other may have a severe open-bite malocclusion.

5. *Local Factors Occur in Combinations, Different Combinations Giving Different Effects. Within the Combinations Some of the Factors May Be Additive or They May Be Compensatory.*—Examples of additive factors can be noted in Class II malocclusions where different combinations of thumb, lip, and tongue forces are associated with different amounts of overjet and overbite.

Local factors in some combinations are compensatory, tending to offset each other. An example is a child with no maxillary lateral incisors but with mesial malposition of maxillary posterior teeth, with well-developed labial musculature, and with early loss of her deciduous lateral incisors and canines so that the maxillary arch becomes fairly well aligned, with the lateral incisor spaces closed. Occasionally, the early loss of a permanent tooth permits eruption of

an adjacent supernumerary tooth into its space so that the extra tooth compensates quite well for the lost original tooth. Sometimes a labiolingual malrelation of incisors in the deciduous dentition is partially corrected when prolonged retention of the mandibular deciduous incisors deflects the oncoming permanent incisors toward an improved relationship.

6. *Local Factors Seem to Exert Their Influences Principally on the Dental and Alveolar Structures, Their Effects, If Any, on the More Remote and Basal Structures Being Difficult to Determine.*—For example, a child's deciduous dentition may show a posterior cross-bite, a slightly narrow maxillary arch, and long deciduous canines that seem to be the principal deflectors of his mandible to the right when he closes his mouth. When his mandible is centered, this child has a very symmetrical facial skeleton. The question, for whose answer no objective evidence is available, is whether or not his facial skeleton would become asymmetrical if the cross-bite were not corrected early.

These six summary statements about the local factors that appear on the conventional lists in the orthodontic literature show how greatly the factors vary. Because of their variability, many exceptions and qualifications must be kept in mind when any of these items are related to clinical conditions. Therefore, it seems appropriate to suggest that the traditional list of factors should be rearranged in a way that will direct attention to their variable natures.

TABULATING THE LOCAL FACTORS IN A CHECK LIST EMPHASIZING VARIABILITY

A convenient way to view the local factors is to start from the premise that many of them are simply variations in characteristics and conditions that are acceptable when they are proportionate and coordinated. When there is either too little or too much of some thing, some characteristic, or some action for a particular time or for certain circumstances, the deficiency or excess becomes a potentially damaging agent.

These variable characteristics and actions that may be related causally to some aspect of a malocclusion can be termed either "physical variations" or "operational variations." Under these two major headings can be placed descriptive subheadings indicating specific kinds of status or behavior (Table I). This tabulation includes the items found on the conventional list of local factors, grouping them under related headings. This kind of list emphasizes variability, but it has certain shortcomings. It calls attention only to the nature and location of potentially disturbing influences. It does not suggest the interplay of these influences, nor does it suggest the kind or extent of the damages that these items may produce or the underlying complexes of causes that produce these factors.

Therefore, this kind of tabulation of these local factors can serve only as a check list for the clinician who wishes to survey a patient's problems. The clinician needs more than a check list. He needs to know how to think about the causative factors as they relate to each other, to the particular circumstances

TABLE I. LOCAL FACTORS IN MALOCCLUSIONS

I. Physical variations (deficiencies or excesses) of the teeth
- A. Number of teeth
  - 1. Deficiency (for a given stage)
    - a. Early loss of deciduous teeth
    - b. Loss of permanent teeth
    - c. Failure of teeth (one or more) to form
  - 2. Excess (for a given stage)
    - a. Retained deciduous teeth
    - b. Supernumerary teeth
- B. Size and shape of teeth
  - 1. Deficiency
    - a. Microdont
    - b. Absence or loss of part of a tooth (i.e., caries, hypoplasia)
    - c. Incomplete dental restorations
  - 2. Excess
    - a. Macrodont
    - b. Fused or geminated teeth
    - c. Oversized dental restorations

II. Operational variations (deficiencies or excesses in amount, order, and timing)
- A. Pre-eruption migration and eruption of teeth
  - 1. Deficiency
    - a. Amount of travel
      - (1) Ankylosis
      - (2) Impaction
    - b. Order and timing of travel
      - (1) Late eruption
  - 2. Excess
    - a. Amount of travel
      - (1) Ectopic eruption
      - (2) Transposition
    - b. Order and timing of travel
      - (1) Early eruption
- B. Forces within and around the dentoalveolar structures
  - 1. Deficiency (amount, duration, and direction)
    - a. Proximal contacts
    - b. Occlusal contacts
    - c. Musculature (i.e., open lips)
  - 2. Excess
    - a. Proximal contacts
    - b. Occlusal contacts
    - c. Musculature (i.e., tongue-thrusting, lip-biting)
    - d. Foreign objects, extraoral and intraoral (i.e., thumb-sucking, pillowing habits)

in his patient, and to the undesirable conditions that they may produce. He is not primarily concerned about how these factors are related to the total list of factors that may be discussed in a textbook.

TABULATING THE CAUSATIVE FACTORS IN MALOCCLUSIONS FOR THE CLINICIAN

The anomalous conditions that are found in a patient's dentofacial complex prompt the clinician to search for the causes of these conditions. He seeks causes so that he can plan treatment that will eliminate the adverse influences that are still acting and treatment that will avoid introducing new conditions which may disturb the occlusion during and after treatment.

If he finds disturbing factors that cannot be eliminated, then he plans treatment intended to establish conditions that are least likely to be disrupted

by the influences present in his patient. Thus, the clinician is carried into an analysis of causative factors by the morphologic and functional analyses that he performs as he studies the patient's malocclusion.

As the orthodontist approaches a patient, he knows that he may encounter a wide variety of occlusion problems. He realizes that a malocclusion is the product of uncompensated variations in the parts that make up the dentofacial complex and that the components may exhibit any of a wide variety of deformities, disproportions, malpositions, and anomalous activities. He has come to believe that biologic variation is the rule rather than the exception. And so the orthodontist proceeds to locate the undesirable variations in the dentofacial components, to recognize their nature, and to evaluate the extent to which each contributes to the malocclusion. At this stage he is thinking about the causes of the malocclusion at a very immediate and direct level.

It is possible that the orthodontist may pause and explore the reasons for each of the morphologic and behavioral variations of the dentofacial components as he finds them, but it is more likely that he will proceed to this next stage of his study of causative factors after he has finished his analysis of structure and function.

The orthodontist's analysis of his patient's malocclusion will almost certainly include a more or less complete evaluation of his patient's progress in the major phenomena that occur in the development of the occlusion.

These phenomena are:

1. The growth of the craniofacial basal skeletal and muscular structures, the phenomena that provide space for the developing dental and alveolar structures and that carry them toward their eventual intermaxillary relations.
2. The accession of the dentitions, the processes wherein the teeth form, grow, change positions within the jaws, and erupt so that their crowns emerge into the oral cavity.
3. The positioning of the dental arches and the teeth within the arches, the pattern of movements and stabilizations that occur in response to the forces surrounding the dentoalveolar structures during and after eruption of the teeth.

When significant variations are noted in any of these major phenomena, the clinician looks for clues that will indicate the kinds of disturbing influences that may account for these variations.

If a discrepancy is noted in the size, shape, proportions, and actions of the basal skeleton or the musculature, the clinician considers the categories of heredity, health, and function (Table II, section I).

If undesirable deviations occur in the development and accession of the dentitions, the observer seeks explanations in the heredity, the health status (both general and local), and the space relations among the teeth (Table II, section II).

TABLE II. MAJOR PHENOMENA IN THE DEVELOPMENT OF OCCLUSION AND GROUPS OF FACTORS THAT INFLUENCE THEM

I. Growth of the basal skeleton and musculature
   A. Hereditary potential
   B. Health status
      1. Nutrition
      2. Hormonal balance
      3. Injuries
      4. Infections, general and local
      5. Neoplasms
   C. Function (activity)

II. Accession of the dentitions
   A. Heredity (i.e., hypodontia, supernumerary teeth)
   B. Health
      1. Systemic (i.e., hypothyroidism)
      2. Local (i.e., ankylosis, cysts)
   C. Space for teeth
      1. Size of jaws
      2. Size of teeth
      3. Positions of adjacent teeth
      4. Size, positions, and actions of muscular structures

III. Positioning of the dental arches and the teeth within the arches
   A. Muscular structures, size, posture, and habitual activities
   B. Teeth, active and passive contacts
      1. Interocclusal
      2. Intra-arch
      3. Intra-alveolar
   C. Foreign objects (e.g., fingers)
   D. Injuries
   E. Pathologic growths

If the positioning of the arches on the basal structures or if the positioning of the teeth within the arches is anomalous, the clinician directs particular attention to the many forces that surround the dental arches. He will appraise the muscular structures and their size, posture, and habitual activities, the teeth and their active and passive contacts, the possible contacts with foreign objects, the effects of injuries, and the likelihood of pathologic growths (Table II, section III).

This is the kind of tabulation of causative factors that parallels the way the clinician thinks. Such an outline encourages him to analyze his patient's circumstances into their component influences and to seek the causes underlying the immediate causative factors that he recognizes. He then mentally reassembles these items, this stage of synthesis demonstrating the interplay of the many influences that gave the resultants or net effects observed in his particular patient. He then makes his prediction as to whether or not treatment is needed and, if so, what changes he hopes to produce in order to obtain a stable improvement in his patient's occlusion.

These three activities—*analysis, synthesis,* and *prediction*—are the essence of the clinician's work with etiology. In these activities, the clinician is continually considering the interrelations of the many causative factors that may account for the malocclusion.

Consciously, or unconsciously, he comes to put these factors into a perspective that is best described by the terms *predisposing factors, precipitating or provoking factors,* and *perpetuating factors.* He ignores academic questions about classification of etiological factors, knowing that some conditions that show up locally and are commonly called local factors may be the outcome of constitutional conditions that may, themselves, be congenital or hereditary in origin. He avoids putting a blanket condemnation on a condition or event that is in itself good but simply occurred too early or too late in his patient. He recognizes the possibility that a given event may be disturbing in one patient, but entirely satisfactory in another patient. He ignores statistics that may tell him that a particular condition rarely happens or rarely causes damage. Instead, he looks to see if that condition is present in his patient and strives to evaluate the likelihood of damage occurring under the particular circumstances where it is found. Stated simply, the clinician learns from his experience with all patients, but he works with only one patient at a time and must be continually aware of each patient's individuality.

Within each patient's complex of multiple contributing factors, the clinician seeks to appraise the predisposing and provoking factors leading to the malocclusion. Thus, he recognizes causes and causes of causes.

In many instances the predisposing factors are difficult to determine, either because they are subtle or because they are unknown. Some of these manifest themselves unexpectedly during treatment.

During the treatment of some patients an undesirable tongue-thrusting habit coupled with a developing open-bite may occur. Whether or not the treatment brings about the altered habitual activity of the tongue cannot be determined. This is an obvious example of the many frustrations that may be encountered as the clinician attempts to discover the causes behind the immediate causes.

The approach proposed in the third part of this discussion emphasizes the need for skillful detection and continuous re-evaluation of each patient's problems, and suggests a pattern of thinking that keeps the multitude of influencing factors in proper perspective relative to each other, to the factors that cause them, and to the consequences that they produce.

This discussion of local factors in malocclusion has not pretended to give any final answers. Rather, it has briefly presented the concept of multiple causation, and it has tried to show that understanding can advance as we explain larger phenomena by the means of studying smaller units. As Sir D'Arcy Thompson, the famous morphologist, has said, "All we can do . . . is to analyze, bit by bit, those parts of the whole to which the ordinary laws of the physical forces more or less obviously and clearly and indubitably apply."*

*Thompson, D'Arcy W.: Growth and Form, New York, 1942, The Macmillan Company.

ROUTINE USE OF MINUTE FORCES

HOLLY HALDERSON, D.D.S.,* TORONTO, ONTARIO

ABOUT six years ago, the head of the Orthodontic Department at the University of Toronto, Dr. R. E. Moyers, and I were discussing natural and artificial forces as they relate to orthodontics. I stated that an interesting research project might be to measure accurately the amount of force applied clinically in orthodontic appliances and auxiliary springs.

Subsequently Dr. Moyers, as director, set up a research study on "The Selection of Forces for Tooth Movement."[1] At this time I shall bring to your attention only a few of the facts which were brought to light in this study.

Our first step was to review the research literature pertaining to this study. One researcher by the name of Schwartz[2] brought out the idea of the degrees of biologic effect, stating that the "most favorable treatment is that which works with forces not greater than the pressure in the blood capillaries, (25 Gm./sq. cm.), moving a tooth less than 1 mm. distance."

Gottlieb's[3] scientific work shows that the rate of tooth movement is largely determined by the speed with which the periodontal membrane re-establishes circulation in the areas of pressure and tension. In other words, minute forces which do not interfere with the circulation in the periodontal membrane elicit rapid osseous changes, whereas forces which occlude a large percentage of the periodontal circulation interfere with the desired osseous reactions.

We should also bear in mind that forces interfering with circulation cannot help but cause tissue pathosis. Our task, as orthodontists, is to minimize and control that pathosis.

Our next study was designed to measure precisely the weight of the forces inherent in arch wires and auxiliary springs by means of the strain gauge. (We confined ourselves, for the sake of brevity, to studying wires of an 18-8 type stainless steel alloy.) The strain gauge is an electronic device for accurate recording of minute amounts of force (Fig. 1). It consists of a transducer for converting the force to electrical energy, an amplifier, and an ink-writing oscillograph for providing a written record. Deviations of the pen are proportionate to the force applied to the transducer. The instrument shown is sensitive to force variations of 0.10 gram. At this time let us bear in mind that when a force is applied in this category, 1 ounce equals 27.7 grams.

Presented before the twenty-seventh annual meeting of the Great Lakes Society of Orthodontics, The Chateau Laurier Hotel, Ottawa, Ontario, Oct. 8, 1956.

*Director of Graduate Department of Orthodontics, University of Toronto.

The first bar graph (Fig. 2) shows the effect of varying the size of auxiliary springs soldered and wrapped around a main arch wire. The length of the spring wires was 8 mm.; the deflection was a constant 1 mm. Only the diameter of the spring wire was varied. The range of weights varied from 4 grams for an 0.010 inch wire to 120 grams for an 0.024 inch wire. At this time please take particular note of the force exerted by the 0.014 wire (approximately 14 grams), as I will be showing its clinical application later in this presentation.

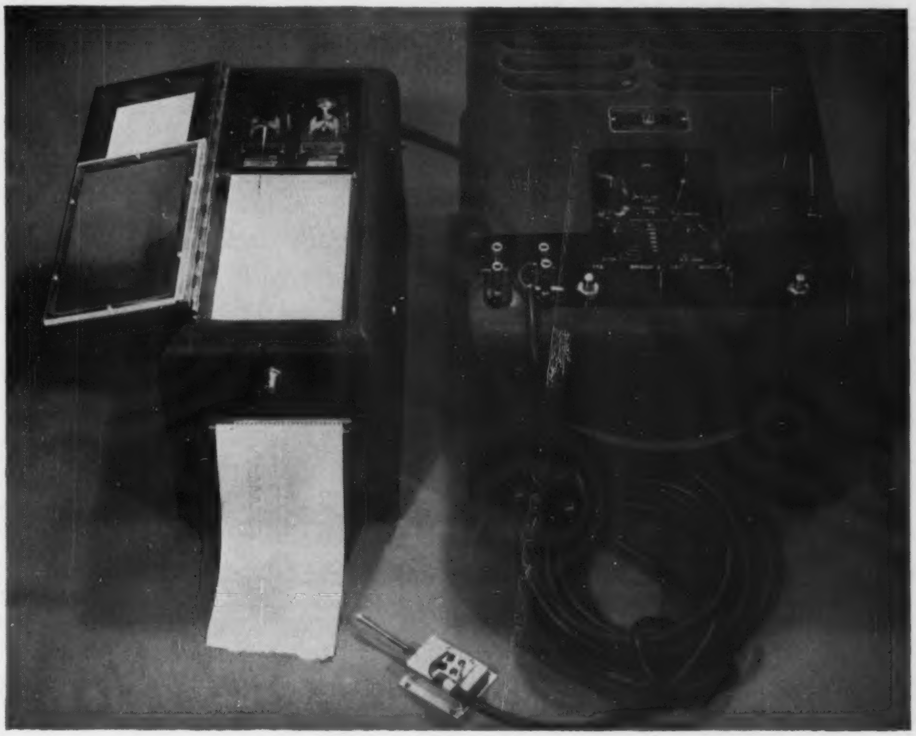

Fig. 1.

In the next bar graph (Fig. 3) we see how varying the length of the spring affects the amount of weight against the tooth. In this instance 0.020 inch wires were soldered and wrapped in a uniform manner around a main arch wire. The spring deflection was a constant 1 mm.; only the length of the lever arm varied. From this experiment, we can readily see that lengthening the lever arm produces a gentler force. It also illustrates why clinicians have favored recurve springs, high vertical loops, and long coil springs.

Thus far we have studied auxiliary springs only. Now let us examine the arch wire itself. Fig. 4 shows the effect of varying the size of round wire in a full "strap-up" employing edgewise brackets on all the teeth. In this case all the readings were taken on a maxillary lateral incisor, all the other teeth being ligated to the arch wire. The distance of arch wire deflection to

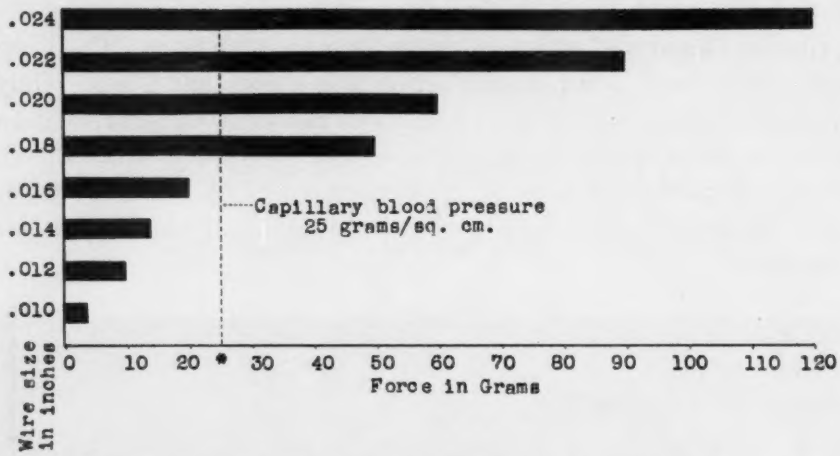

Fig. 2.—Auxiliary springs soldered to high labial arch and wrapped three times around arch wire. (Length of spring, 8 mm.; deflection, 1 mm.)

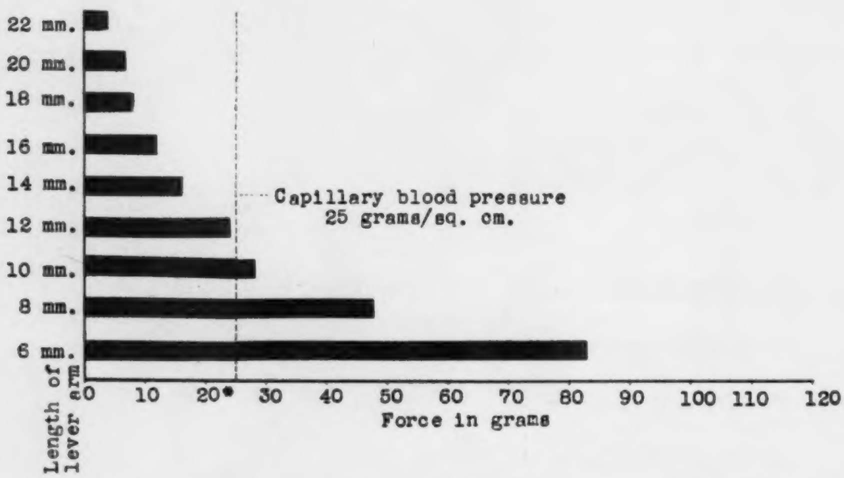

Fig. 3.—Effect of varying the length of an auxiliary spring (.020 inch round wire soldered and wrapped three times). (Deflection, 1 mm.)

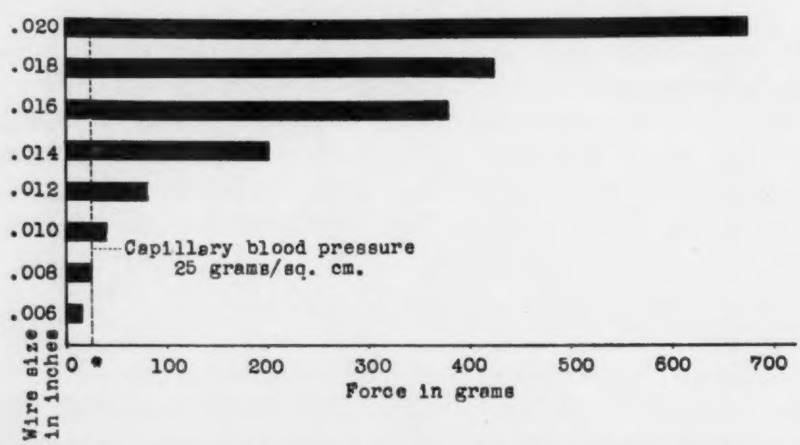

Fig. 4.—Effect of varying the size of round wire in edgewise brackets. (Distance of deflection to bracket seat of maxillary lateral incisor, .020 inch.)

the bracket seat was a constant 0.020 inch. In every instance we have measured the amount of force required to move the wire to the bracket. There is a mobility of the tooth in its alveolar socket. This mobility allows part of the distance to be absorbed by the tooth moving to the wire, especially when heavy wires are used. Therefore, after the tooth is ligated to the arch wire, all of these forces decrease slightly.

Fig. 5 shows some of the forces used in the wires that make up the Johnson appliances. Again, the force weight against a maxillary lateral incisor was tested with the arch wire deflection to the bracket seat held at a constant 0.022 inch. Flat wires, twin wires, and a single 0.010 inch wire are shown in the bar graph. Of particular interest is the great difference in weights shown between flat wires of 0.012 inch and 0.010 inch thickness.

When we examine the bar graphs in Figs. 4 and 5, we can readily see that in using wires of the diameter recommended by the majority of clinical orthodontists who use the mechanically efficient twin wire or edgewise mechanisms, the high force range of these heavier wires makes it impossible for the clinician in his routine practice to make adjustments in a force range as low as the capillary blood pressure (25 grams per square centimeter). This fact does not necessarily condemn these orthodontic mechanisms, provided that the high force is less than the width[4] of the periodontal membrane and that this force is not reapplied before repair to the tissues has been established.[5]

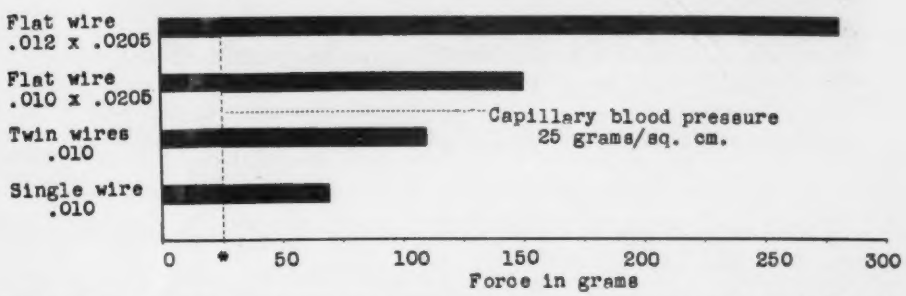

Fig. 5.—Force range in Johnson type appliances. (Distance of deflection to bracket seat of maxillary lateral incisor, .022 inch.)

Let us now examine one method of practicing orthodontics with the routine use of minute forces. For my discussion I shall select the essayist's favorite—the Class II, Division 1 malocclusion.

Fig. 6 shows the right and left anteroposterior (A-P) relationship of the dental arches. The front view includes the maxillary position of an 0.040 inch high labial arch wire with 0.030 inch spring stop locks and 0.030 inch elastic hooks in the canine region for 1 or 1.5 ounces of intermaxillary force.

All wires are of an 18-8 type stainless steel. The 0.040 inch maxillary lingual arch wire shows 0.014 inch spring wires soldered, wrapped three times around the main arch wire, and fitted over the contact of the first and second molars.

My first concern in the treatment of Class II cases is to obtain an overtreated anteroposterior relationship of the second and first maxillary molars to the mandibular molars, that is, if the lower lip does not constantly rest lingual to the maxillary incisors. If this condition exists, the first stage of treatment is retraction of the maxillary incisors far enough to allow the patient an approach to normal lip closure. The technique of retracting the maxillary incisors will be explained later.

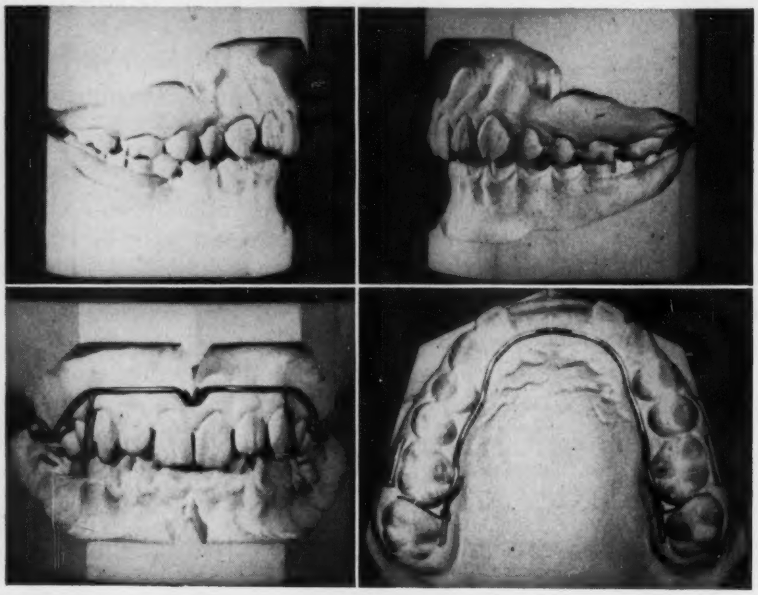

Fig. 6.

The total number of appliances used in correcting the anteroposterior relationship of the buccal segments is four first molar bands, maxillary high labial and lingual arch wires, a mandibular lingual arch wire, a few auxiliary spring wires, and 1 to 1.5 ounce elastics.

Fig. 7 shows the mandibular lingual arch wire with several individual auxiliary springs. (This was a case of cross-bite on the left side.) The remaining illustrations in Fig. 7 show the improvement of the anteroposterior relationship of the buccal segments after approximately three months of treatment.

In the great majority of Class II cases the first teeth to be moved, if they have erupted, are the maxillary second molars. The springs to these molars are deflected approximately 1.5 mm., and this deflection is maintained against the second molars until they have tipped into an overtreated anteroposterior relationship (approximately 3 months). Very frequently there is no apparent movement of the second molars for the first three to six weeks of treatment. They will, however, eventually move or tip distally without increasing the deflection of the springs beyond the approximate 1.5 mm.

The high labial arch wire was, I believe, originally designed and used most efficiently by Dr. Lloyd S. Lourie[6, 7] of Chicago. I first learned about the possibilities of this appliance when I was associated with Dr. Harvey Bean in the 1930's. In the "old days" the buccal tubes were quite short (now they are ~9 mm.) and the arch wire was brought up rather abruptly in front of the tubes and quite high under the lip. This design led to frequent lacerations of the soft tissues. The high labial arch wire of today is only 3 to 5 mm. above the gingival margin of the central incisors and the sharp bends have been somewhat streamlined.

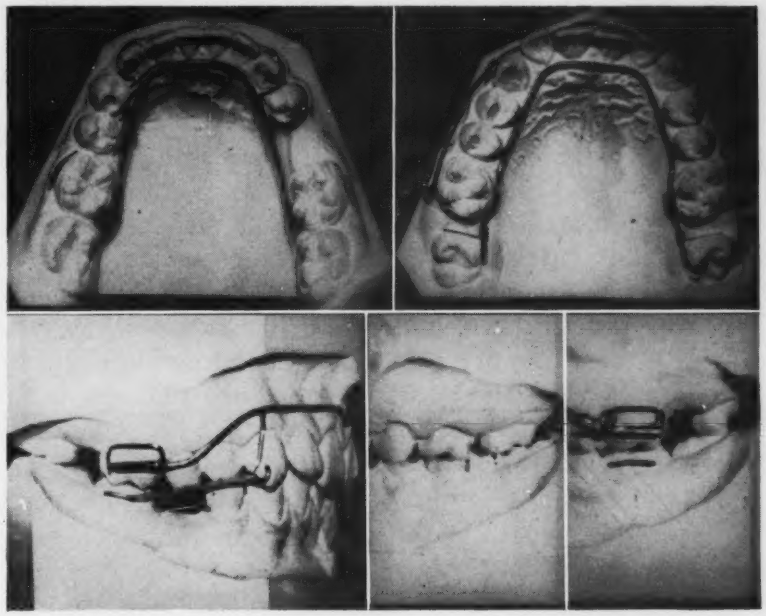

Fig. 7.

The 0.030 inch elastic hooks are soldered in the canine area and brought down almost to the occlusal plane. If the distance from the mandibular molar elastic hook to the maxillary hook is approximately 22 mm., the intermaxillary force obtained from a $\frac{5}{16}$ inch latex medium elastic will be 1 to 1.5 ounces.

The patient is instructed to remove these elastics at mealtime to avoid producing unnecessary mobility of the maxillary first molars. As the maxillary first molars move distally, the stop locks on the high labial arch wire are also moved distally far enough to keep the arch wire 2 mm. away from the gingival tissue in the anterior region. The patient must be warned to discontinue the elastics temporarily if "they pull the wire against the gum tissue above the teeth." Unless his next appointment is within two or three days, he should let the orthodontist know about this condition so that the wire can be set farther forward. The total anchorage for this light intermaxillary force is a "standard" mandibular lingual arch wire. One need have no concern about losing anchorage if the intermaxillary force is not over 1.5 ounces.

With patients who cooperate 100 per cent in wearing the elastics, I find that a 1 ounce force from each elastic is quite sufficient in this technique. I seldom attempt to move more than two maxillary teeth at a time. In the majority of cases, I am pleasantly surprised to find that, after the mesial inclined plane of the mesiobuccal cusp of the maxillary second molar begins to contact the distal inclined plane of the mesiobuccal cusp of the mandibular second molar, the Class II relationship of the dental arches begins to "unlock." The maxillary first molars assume a more distal relationship with mandibular first molars and diastemas appear between the maxillary molars, premolars, and canines. Fig. 7 (lower right) shows "before and after" views (approximately three months of treatment) of the anteroposterior relationship of a buccal segment of the above case.

At this stage (Fig. 7, lower right) the force is entirely removed from the maxillary second molar springs, thus allowing more distal force on the maxillary first molars. Occasionally the second molar springs have to be reactivated and again released before the first molars assume an overtreated anteroposterior relationship with the mandibular first molars. Another pleasant surprise in this plan of treatment is that rarely do the maxillary second premolars require any assistance to establish the correct anteroposterior relationship with the mandibular dental arch. Dr. Robert E. Moyers, who has done considerable research work on the periodontal membrane, is of the opinion that this movement of the maxillary second premolar is the result of a stretching or pulling of the transeptal fibers between the distally moving maxillary first molar and the second premolar.

Usually the maxillary first premolars require some help to assume their normal anteroposterior relationship with the mandibular teeth. When the maxillary second and first molars are in an overtreated relationship with the mandibular dental arch, the maxillary lingual arch wire is removed. Spring wires (0.014 inch) are soldered onto the high labial arch wire mesial to the first premolars and wrapped distally. These springs are fitted to the mesial side of the first premolars, as shown in Fig. 8. When activated, the distal deflection is never more than 1 mm.

The elastic routine remains the same. If the overtreated relationship of the molars seems to increase, two maxillary canine springs are added and fitted in the same way as the premolar springs. Again, the deflection is never more than 1 mm. If there is a slight loss of the overtreated anteroposterior relationship from the 1 mm. deflection of the four springs, the deflection is partially or totally removed from the canine springs. In some cases, after the maxillary first premolars and canines have been tipped distally, the apices of the canines have to be moved distally. The canines are banded. The distal root movement is accomplished by means of similarly attached springs, but they are 0.012 inch in diameter and are fitted into 0.014 inch horizontal channels, tubes, or brackets on the canine bands. For banded teeth, springs off a high labial arch wire are turned at right angles at the level of the channel and the horizontal portion is inserted from the mesial end of the channel.

When teeth can neither be rotated nor the roots moved by auxiliary springs, they are banded and similar brackets and springs are used as described for the canines.

If roots have to be moved lingually or labially, a wide horizontal channel is welded onto the band. The free end of the 0.012 inch spring wire is doubled back the length of the channel on the band, thus forming a flat end on the auxiliary spring which is fitted into the wide channel.

After the maxillary first premolars and canines have been moved to their correct anteroposterior relationship with the mandibular dental arch, the first premolar springs are removed. (Fig. 8, top right, should show spring touching premolar.) The deflection, if any, is removed from the canine spring wires and four 0.014 inch maxillary incisor spring wires are fitted onto the arch wire (Fig. 8). Only two of these springs are deflected 1 mm. against the most prominent maxillary incisors. The other two remain inactive until the next adjustment (three weeks), at which time they are deflected approximately 0.5 mm. No further deflection is added to the other incisor spring wires until the third visit, at which time the increased deflection may only be a small fraction of 1 mm. The total force application of the four incisor springs should not be greater than the force obtained from the 1 ounce intermaxillary elastics.

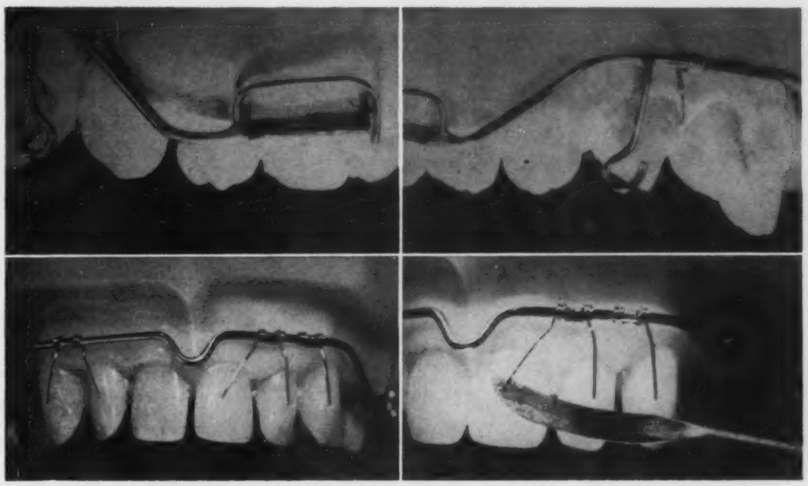

Fig. 8.

I am inclined to agree with Dr. Joe Johnson,[8] the twin-wire expert, that "When force has been applied to these light wires, you must not bind or tie them tight in the brackets. You must give the wires a chance to move in the brackets and the periodontal membrane a chance to breathe." I have found clinically that if force application is less than the capillary blood pressure and the wires do not bind in the brackets, the patient does not experience any pain reaction. The one great advantage in the use of these individual springs,

whether they are fitted into channels or brackets on banded teeth or just contacting the teeth, is the fact that the operator knows, at all times, the type and amount of force (within a few grams) that he places on every tooth in the dental arch.

In a great majority of these Class II cases, the overbite begins to improve as soon as the molars are approaching a normal anteroposterior relationship. In any event, the maxillary incisors are gradually retracted until they are contacting the mandibular incisors. If an excess overbite prevents full retraction of the maxillary incisors, a bite plane (Fig. 9) is constructed. The 0.030 inch labial wire has shallow canine loops to avoid interfering with the

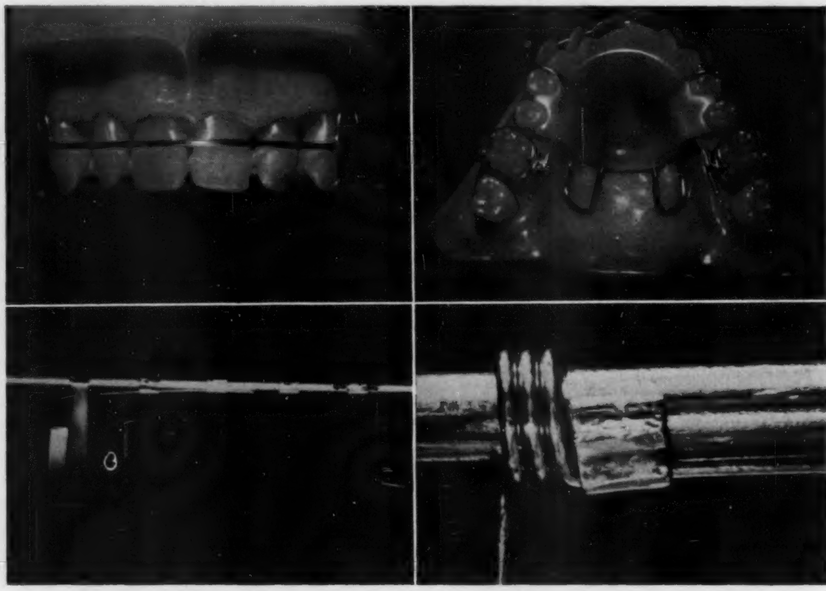

Fig. 9.

high labial arch wire which may be used to maintain part-time intermaxillary force. Usually all the auxiliary springs are stripped off the high labial arch wire if it is used in conjunction with this type of bite plane. The 0.036 inch S wires on the palatal portion of the bite plane are so adjusted that they will snap under the lingual tubes when the patient bites on the bite plane. If the bite is not opened more than 2 mm. at a time, the patient becomes accustomed to the appliance very quickly. The palatal S wires effectively keep the bite plate up in position. They also help in bringing the four six-year molars quickly into occlusal contact.

After the overbite has been reduced enough to allow the retraction of the maxillary incisors to be completed, the bite plane is removed and spring wires for the incisors are again attached to the high labial arch wire. If this final retraction completes the treatment of the maxillary dental arch, a retainer is constructed and the patient is asked to wear it half-time (for example, from 7 P.M. to 7 A.M.). This routine is carried out for a minimum of six

months; thereafter it is removed for three-night week ends for another six months and then discontinued. If the original malocclusion included severe rotations of the anterior teeth, the part-time retention may be extended over a total period of two years. The design of this retainer is similar to the one described previously, except that there is no bite crib nor S wire on the palatal portion.

If it is desirable to reduce the overbite further, the maxillary six-year molar bands are left in place and a bite plane is constructed of the design shown in Fig. 9. The patient is asked to wear this bite plane at all times for a period of six to twelve months; thereafter the routine is reduced to twelve hours per day followed by three-night week ends off for another total of six to twelve months. When the twelve hours per day routine is started, the maxillary six-year molar bands and S wires are removed.

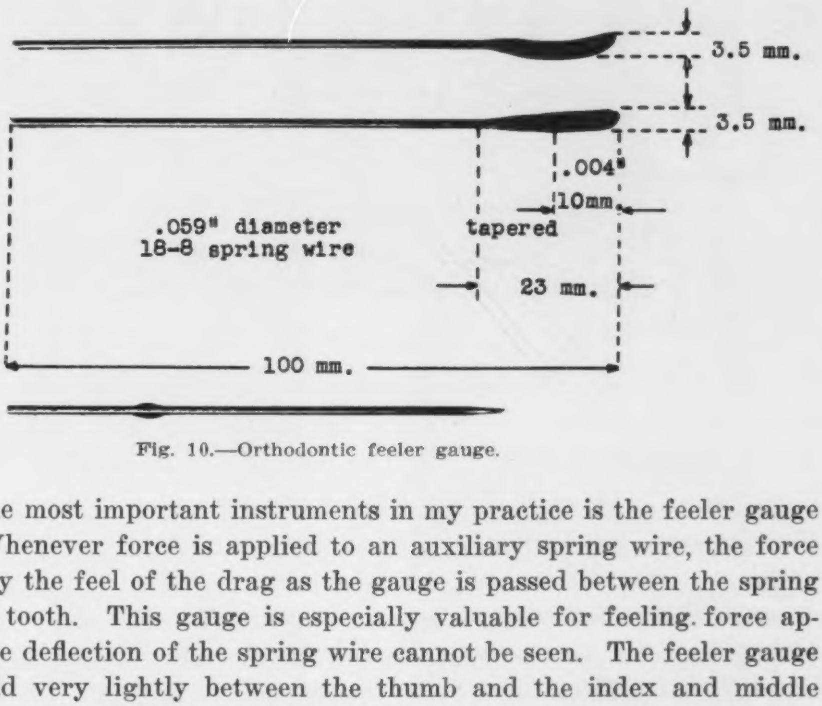

Fig. 10.—Orthodontic feeler gauge.

One of the most important instruments in my practice is the feeler gauge (Fig. 10). Whenever force is applied to an auxiliary spring wire, the force is measured by the feel of the drag as the gauge is passed between the spring wire and the tooth. This gauge is especially valuable for feeling force application if the deflection of the spring wire cannot be seen. The feeler gauge should be held very lightly between the thumb and the index and middle fingers. The gauge should not be allowed to touch the lips or cheek, as these tissues will interfere with the feel of the force in the spring wire.

Dr. Egil Harvold,[9] orthodontist and expert cleft palate researchist, suggested "stitching" (spot welding) channels, of half-width molar banding, on arch wires to receive auxiliary spring wires which are then wrapped around the main arch wire as shown in Fig. 9. This channel type of attachment of the anterior spring wires is also shown in Fig. 8. If one spring wire, rather than two per channel, is indicated, the wire is wrapped around the arch wire on each side of the channel and the dead end of the spring wire is cut close to the arch wire.

The channels on anterior bands are made from full- or three-quarter-width anterior banding (Fig. 11). If channels are indicated on molar bands, molar banding is used. Pliers with slotted beaks are very useful in forming these channels on bands or arch wires (Fig. 11).

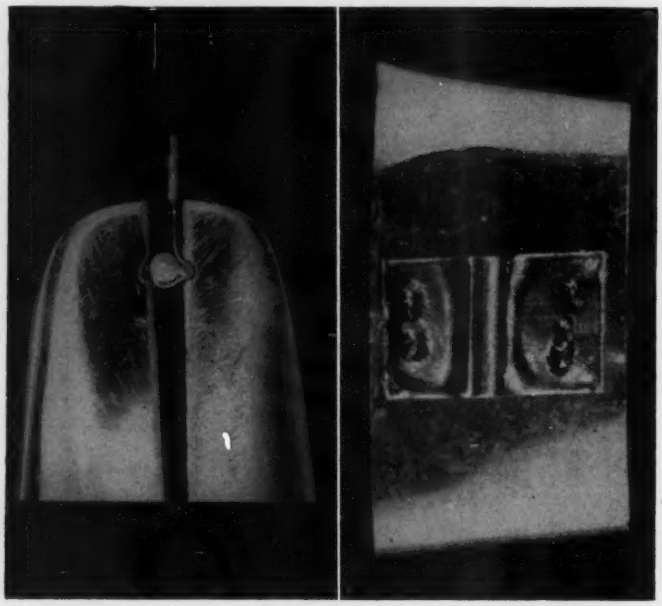

Fig. 11.

Two other very useful adjuncts to this technique are the recurve spring wire and the linked spring wires for uprighting and rotating mandibular anterior teeth (Fig. 12). Of course, adequate arch length is a prerequisite. Combining the force of these spring wires, I never find it necessary to band these anterior teeth unless the roots of some of the teeth are grossly out of position. This combination of spring wires and the lingual arch wire is excellent when mandibular premolar extraction spaces are being closed. After the anterior teeth have been uprighted and rotated, the half-round post on one side of the lingual arch wire is moved mesially approximately 1 mm. In three weeks the post on the other side is moved mesially 1 mm. In three to six weeks the original post is moved again approximately 1 mm., and so on until the extraction spaces are closed. If there is danger of tipping the mandibular anterior teeth too far lingually when this method of mandibular space closure is being used, 1 ounce intermaxillary elastics may be added to the treatment procedure. The maxillary high labial arch wire is replaced by a low labial arch wire contacting the maxillary anterior teeth at the junction of the gingival and middle thirds of the crowns. However, if further retraction of some of the maxillary teeth is desirable, it may not be necessary to change to a low labial arch wire.

When force has been applied to these spring wires, it is often difficult to see their deflection when the arch wire is placed in position. I always test the force application with a feeler gauge. The feel of the force should not be more than that which is experienced in testing the force of an 0.014 inch maxillary incisor spring wire which has been deflected 1 mm. Fig. 13 shows

Fig. 13.

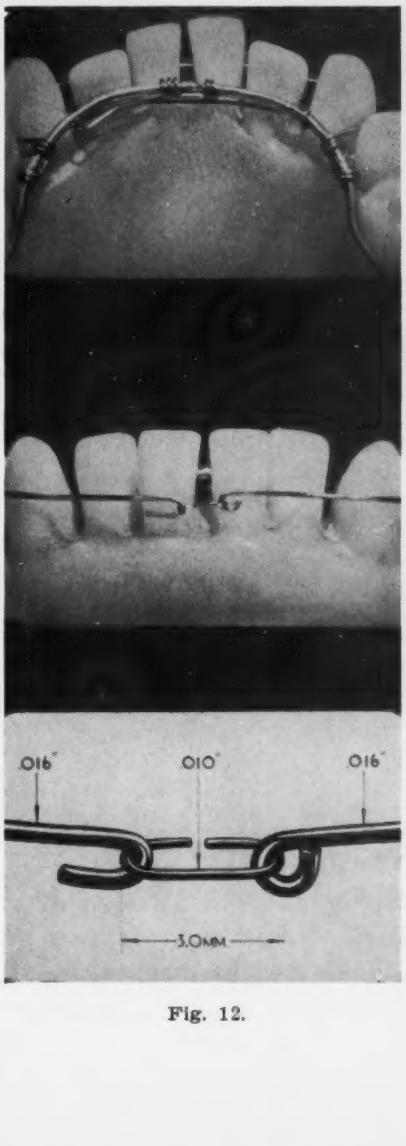

Fig. 12.

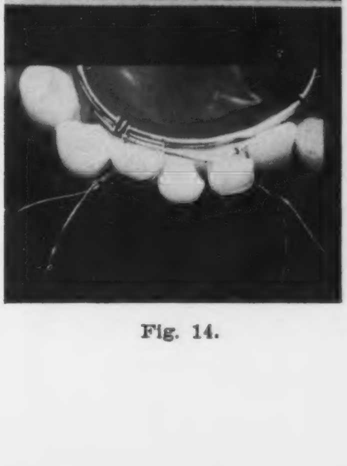

Fig. 14.

two premolar extraction cases, before and after approximately six months' treatment with a mandibular lingual arch wire with an 0.014 inch lingual recurve and 0.016 inch labial link spring wires.

Fig. 14 shows another method of rotating or tipping mandibular incisors lingually with an 0.014 inch recurve spring wire and 0.007 inch ligature wire. With careful adjustment of the recurve spring wire and the 0.007 inch ligature wire, mandibular incisors can also be intruded (two at a time). At all times an attempt is made to have the force application less than the capillary blood pressure. Fig. 14 also shows a lateral incisor ligated to the lingual arch wire with the activated recurve between the ligated tooth and the arch

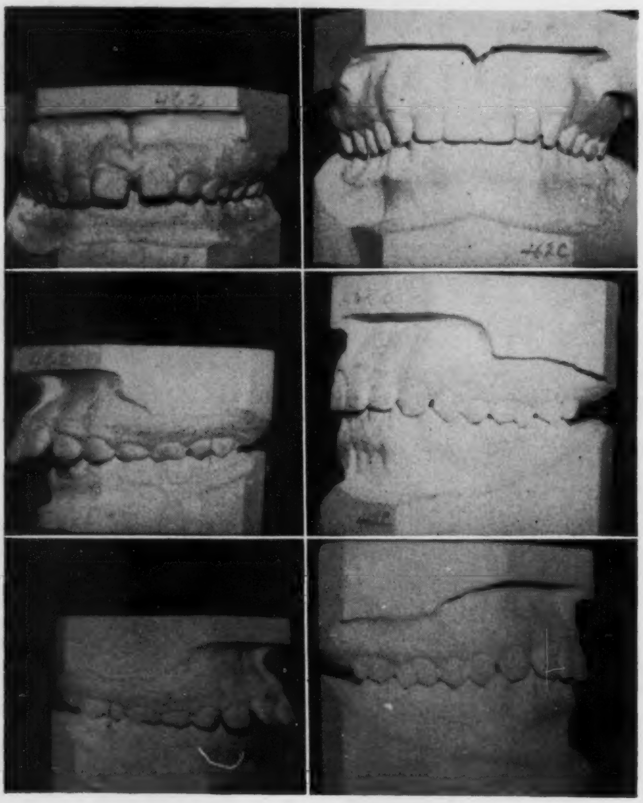

Fig. 15.

wire. This method is not as efficient for correcting rotations as ligating directly to the spring wire. Also it is easier to assess the force application when the spring wire is ligated directly to the tooth.

Figs. 15, 16, 17, 19, and 21 show "before and after treatment" casts of Class II, Division 1 malocclusions. All these cases were treated with the technique, procedure, and minute forces described in this article. In each case the only teeth banded were the four six-year molars. The procedure in

Fig. 17.

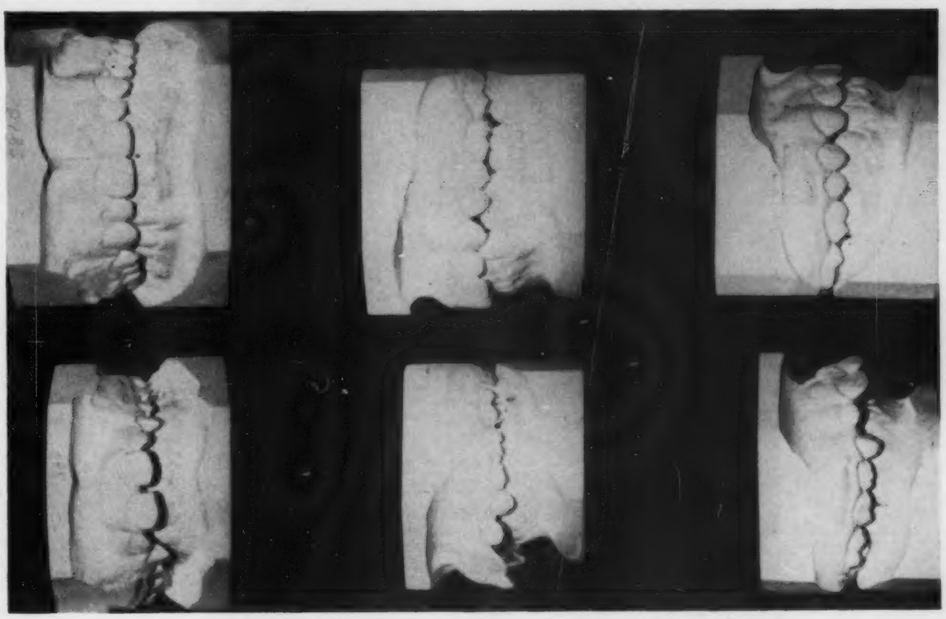

Fig. 16.

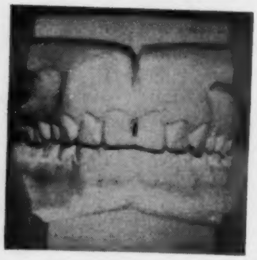

Fig. 18.

Fig. 19.

treating the case in which all the mandibular teeth were completely lingual to the maxillary teeth (Fig. 16) was only slightly altered, a bite plate being added at the beginning of treatment.

Fig. 18 shows plaster casts that were obtained three years after all retention was removed from the case shown in Fig. 17. Fig. 20 shows plaster casts that were obtained five years after all retention was removed from the case shown in Fig. 19. The mixed dentition case (Fig. 21) is rather interesting in that the patient had a finger-sucking habit, as well as a habit of resting the tongue between the incisors. The appliances used were four six-year molar bands, a maxillary high labial arch wire with four incisor spring wires, a mandibular lingual arch wire with an anterior recurve spring, and *1 ounce elastics worn only at night.* The patient's cooperation in breaking these habits was excellent. As the patient lived out of town, appointments were made at

Fig. 20.

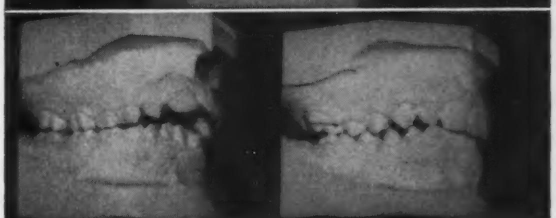

Fig. 21.

Fig. 22

five-week intervals. The plaster casts (Fig. 21, right) were obtained sixteen months after treatment was started. My purpose in including Fig. 22 in this article is mainly to show that Class III types of malocclusion can also be treated by using minute forces.

SUMMARY AND CONCLUSION

Some years ago, when I first adopted this procedure as well as the use of minute forces in correcting Class II, Division 1 malocclusions, I was amazed at the ease with which the maxillary posterior teeth could be brought into a

Class I relationship with the mandibular teeth. All this was accomplished without setting up a "pressure area" in the maxillary premolar region, as so often recommended in the Johnson technique or plan of treatment, or even using a multiband and root-moving technique to mass move these teeth into a Class I relationship. I cannot explain the apparent ideal axial position of the treated maxillary posterior teeth. One would think that the roots of these teeth should all have an anterior displacement and yet, according to the plaster casts, the maxillary six-year molars appear to have a posterior displacement of the roots.

I am quite well aware that opinions are most unscientific. Yet, I should like to state, unscientifically, that I am of the opinion that in addition to normal growth, the mandible starts a "forward and downward migration" as soon as the Class II inclined plane relationship of the molars is "unlocked." I do not think that it is reasonable to infer that all of the improvement of the anteroposterior relationship in the dental arches, as shown in Fig. 7 (lower right), can be attributed to the distal tipping of the maxillary molars, the forward and downward growth of the mandible, and the appearance of approximately 1 mm. diastemas between the maxillary premolars and canines after three or four months of treatment. I have carefully tested the centric closure pattern of these patients and they all seem to be comfortable and "normal" in the improved anteroposterior relationship. I have also observed, in treating these cases, that very seldom is there any sign of a relapse of the anteroposterior relationship of the dental arches after they have been treated to a Class I relationship.

Another unscientific opinion of mine was that I moved maxillary molars and premolars posteriorly in the treatment of Class II cases. But, after studying a few cephalograms, it seems that in some cases I may have tipped the molar crowns posteriorly and in others I may have prevented the molars from moving forward with the rest of the normal growth of the maxilla. However, I cannot state dogmatically that this observation is correct, because my samples of cephalograms were much too small to be of any statistical or scientific value. Still, if I have only prevented these maxillary posterior teeth from moving forward with normal maxillary growth, it may explain to some extent the ideal axial position of these teeth after obtaining a Class I relationship with the mandibular teeth.

Dr. Gustav Korkhaus,[10] University of Bonn, has done some outstanding research work on the forward repositioning of the mandible, sometimes called "jumping the bite." In this study serial radiograms were made of the temporomandibular joint of hundreds of these cases under treatment. The radiograms showed a gradual reshaping of the glenoid fossa over the anteriorly positioned head of the condyle. I believe this change in the temporomandibular joint took place over a period of eighteen to twenty-four months of treatment in the age range of 12 to 16 years. When this scientific work is published it should be very valuable to the clinical orthodontist, regardless of the type of appliance therapy he uses in practice.

At this stage, you may be wondering what prompted this thinking on minute forces. Well, when I was in my teens, as a technician with the late Dr. George Grieve, I was introduced to orthodontics and the painstakingly accurate multiband pin-and-tube appliance. I might add that many years later I was also introduced to the edgewise appliance technique. Many of the teenage patients would visit my laboratory while awaiting their turn for appliance adjustments. Those who showed interest in my future asked what I was going to do when I grew up. I said that I was going to be an orthodontist. Let us not forget that these patients were teenagers talking to a teenager. "Do you know how to be the best orthodontist in the world?" they said. "No," I replied. "Well, straighten teeth without using bands that look horrible and hurt."

The seed of my thinking in orthodontics was planted in as simple a manner as that thirty years ago. I am not casting derogatory aspersions upon Dr. Grieve or his work. No one was more exacting in his appliance adjustment or technique than he. But the alloys and materials available today for orthodontic appliances are far superior to those of thirty years ago. It was an accepted belief that some pain must accompany orthodontic tooth movement. In those days research studies in the physiology of tooth movement were just beginning.

Malocclusions develop without pain. Why can they not be corrected without pain? They can. We have all seen malocclusions resulting from thumb-sucking. In many of these cases the abnormal force is being applied for only about forty-five minutes out of twenty-four hours. I was convinced many years ago that, following these simple facts to their logical conclusion, all malocclusions could and should be corrected without pain. I am still of the opinion that if I cause any pain at all in the manipulation of my appliances, I have been clumsy and that I have exerted a force greater than that of the capillary blood pressure.

Assuming that the specific findings of the research workers mentioned in our study on forces are correct, and assuming that our pilot study on forces is fairly accurate, then it seems reasonable to conclude that the forces used in the correction of these malocclusions are less than that of the capillary blood pressure (25 grams per square centimeter). In other words, physiologic tooth movement can be obtained clinically day in and day out in an orthodontic practice—perhaps not 100 per cent of the time, but very near that degree of perfection.

Because of my present status on our University staff, I wish to announce that we are not what is popularly called a one-appliance school. We teach edgewise, twin-wire, Universal, monoblock, and labiolingual techniques. Yes, this conglomeration of techniques may confuse *some* of the graduate students, but at least lazy thinking is discouraged.

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ANALYSIS OF EARLY CLASS II, DIVISION 1 TREATMENT

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INTRODUCTION

In speaking of early orthodontic treatment we invariably mention the importance of correcting cross-bites, Class III malocclusions or Class I malocclusions that may resemble Class III conditions, and severe Class II, Division 1 malocclusions. We can read this admonition in our textbooks and journals or hear it from orthodontic educators. We read and listen and then many times we will treat everything but the Class II, Division 1 malocclusions. These seem always to need a second period of treatment and sometimes a third period is required. When these cases come into our offices they may not seem severe enough to treat now, or perhaps we feel that they can be treated better later.

The object of this article is to report in some detail the results observed from the evaluation of severe Class II, Division 1 malocclusions treated in the deciduous dentition. We are interested at present primarily in what happened during the treatment period: Was there change in relationship of maxilla to mandible? Where did it occur? Was the treatment worth while in the light of the changes which occurred?

CLASS II, DIVISION 1 MALOCCLUSIONS

Extreme Class II, Division 1 malocclusions present a problem in facial relationship as well as occlusion. While all malocclusions in this group will vary somewhat, there are three general characteristics common to the group, and each of these is a particular problem. We will find an abnormal maxillo-mandibular base relationship, an excessive amount of overjet, and generally a deep overbite.

It is an old problem, and varied expressions of opinion as to when treatment should begin are not uncommon in the literature.

In Angle's[1] *Malocclusion of the Teeth* (seventh edition) we read: "It becomes an axiom, that the proper time to begin treatment is as near the beginning of the variation from normal in the process of development of the dental arches as possible." Those who treat severe Class II, Division 1 malocclusions during the deciduous dentition must have this in mind, for if the

This thesis, which was given as a partial fulfillment of the requirements for certification by the American Board of Orthodontics, is being published with the consent and the recommendation of the Board, but it should be understood that it does not necessarily represent or express the opinion of the Board.

discrepancy in facial relationships can be overcome early, then most certainly our patients should have a better chance for harmonious development of the teeth and supporting structures.

The opposite view is expressed by Hellman,[2] who writes: "Early treatment tends to prolong indefinitely the period of orthodontic care and offers no assurance of better end results." This view is held by many orthodontists who feel that they can achieve comparable results from treatment instituted in the mixed or permanent dentition.

Hahn[3] has advocated early treatment for many years, even if three periods of treatment are necessary in the most extreme cases. He writes: "We believe that in practically every case so treated (that is, in the deciduous dentition) there has been a sufficient decrease in the severity of the secondary malocclusion to warrant such a procedure."

Graber,[4] in an evaluation of fourteen cases, is not so certain. He reports that three patients made the grade as far as tooth relationship was concerned, but that well over one-half of the patients had a Class II relationship of a lesser degree at the end of treatment. While this may seem discouraging, he further reports that eleven of the patients showed anteroposterior base adjustment and that most patients showed improvement in muscle tone and function.

While Graber does not give a detailed analysis of treatment results, his generalizations as to what was accomplished seem to suggest that while tooth relationship may have left a little to be desired in some cases, the over-all changes were worth while.

We have collected before- and after-treatment headfilms of eighteen treated Class II, Division 1 malocclusions. While this number is certainly not large enough to be used in a statistical study, it was felt that certain indications as to what we could expect in the way of facial changes would be found.

As a criterion of severity, all the patients exhibited a definite Class II molar relationship with a marked protrusion of the maxillary anterior teeth. The average amount of overjet was 10 mm. Some of these had associated sucking habits which may have increased the protrusiveness of the maxillary arch. Most of the patients had deep overbites; in a few the degree of overbite might not be considered too abnormal. The age of the patient at the beginning of treatment varied between 3 and 4½ years.

Before- and after-treatment tracings were made of each patient. They were analyzed, using the superposition methods outlined by Steiner.[5] In addition, in order to check the effect that a prominent chinpoint or change in mandibular plane angle might have in relation to soft tissue esthetics, the angle SN-PO was measured and compared.

While I felt certain that a change in tooth position with treatment would be seen, I was particularly interested in determining just how the jaw relationships would be altered, if at all. I was interested in seeing how far the deciduous second molars and incisors were moved distally and in observing the effect of movement of these deciduous teeth on the permanent maxillary molars and central incisors.

All of these patients were treated by means of maxillary extraoral traction. Eight of them, in addition to this traction, were subjected to light intermaxillary elastic pull toward the end of treatment. The treatment time in these cases ranged from eight to thirteen months.

The superpositioning methods of Steiner[5] were selected to demonstrate changes that occurred during the treatment period, as it was felt that they depict more graphically what has occurred in a given period of time.

In the comparison of over-all changes, the line SN with S registered was used as a base line. Variation in the angles ANB and SN-PO will identify anteroposterior changes in which the mandible or maxilla has assumed a different relationship with the cranial base.

When we choose to observe the changes anteroposteriorly due to orthodontic treatment and minimize the effect of growth, we can do this by superimposing on the line SN so that the N points coincide.

The vertical growth can be canceled out by transferring the original NA line to the second tracing when the N points are superimposed. Then, by shifting the tracings along the line NA until the structures of the maxilla coincide to the greatest extent, the amount of change that has occurred in the maxilla can be assessed.

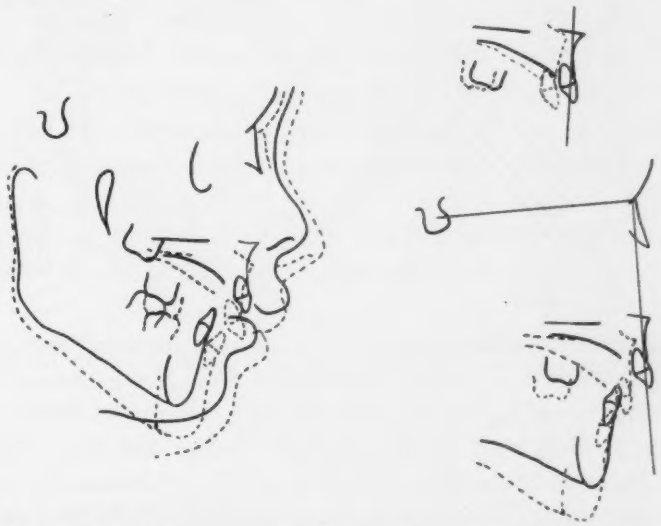

Fig. 1.—The broken line indicates good generalized growth during this period, as well as definite distal position of the teeth and point A.

Evaluation of the results of treatment is an analysis of how specific areas were affected by the growth and how they were affected by appliance therapy during the interval between the headfilms.

There was a satisfactory correction of tooth relation, as well as improvement in facial esthetics in all the cases studied. The different ways in which this improvement, especially in facial balance, was accomplished is interesting. In general, they can be divided into three types of response.

The first of these types is illustrated by Fig. 1. When the tracings are superimposed on the line SN with S registered, the broken line indicates the

changes that have taken place during the eleven months the patient was under treatment and the first nine months of retention. There is a twenty-month period between the headfilms. Nasion has moved forward. It will be noticed that the maxilla appears to have changed its position in a vertical direction only. The mandible appears to have enjoyed a favorable amount of growth in a direction that we would like to see more often. The mandibular angle has become steeper, which in this case might be attributed to the use of intermaxillary elastics.

Remember, this is a picture of over-all change. We can examine specific change in the maxilla more closely by using the original NA line transferred to the second tracing and then registering the maxillae of the two tracings where they are best oriented in relation to one another on this line. This has been done in the upper right-hand corner of the illustration. In this way changes that might be due to vertical and horizontal growth are nullified. We observe that point A is more distal than in the original tracing, as are the deciduous incisor and molar. The permanent molar and central incisor, while not shown, follow a similar pattern.

To record other changes in the anteroposterior direction we can superimpose on the line SN with the N points registered. Changes which we can observe then in this plane can be attributed largely to orthodontic treatment.

We see that the mandible is in the same anteroposterior relationship to the cranial base as it was in the beginning of treatment. It has changed only in its vertical relationship. It continues its forward growth at approximately the same rate as the base line SN. There is little evidence here of what we thought was good mandibular growth when we looked at the over-all tracings. Improvement, then, was achieved through alterations in the alveolar portion and teeth in the maxilla.

There has been established a better relationship between the jaws. The angle SNB has increased 1 degree. The angle SNA has decreased 3 degrees, to give a net favorable change of 4 degrees. The deciduous molars were moved distally 4 mm., as indicated by an increase in the distance from NA to the distal side of the second deciduous molar which accounts for the change in the tooth relationship. The upper incisors were moved back 8 mm. I believe also that the increase in vertical height has helped the facial esthetics. Improvement in this case was due not so much to a good amount of favorable growth, but to the fact that there was considerable distal movement in the maxillary arch.

There did not seem to be any significant difference in anteroposterior relationship between those cases which had light intermaxillary elastics toward the end of treatment and those which did not, although three of the cases in which elastics were used showed a change in the mandibular plane angle of about 3 degrees. There was no startling change in the anteroposterior position of the mandible, except in one case, when the angles SNB and SN-PO were compared in the two sets of tracings.

In this series there were three cases in which the angle SNB improved by more than 1 degree during treatment. Fig. 2 shows this type of response. There is a ten-month interval between the two headfilms. Here we have a picture of a good amount of generalized growth and good distal tooth movement. We will note that the over-all growth seems to be about equal, except in the mandible, when we superimpose on the line SN with S registered. Points N, A, and B have come forward, and there has been some increase in length of the face due to vertical growth. In the upper right-hand corner you will notice that there has been no change in point A or alveolar area, as we saw in the previous illustration. We can record only distal movement of the incisor and molar. In the lower corner we see the principal reason for the improvement in relationship of bases. The mandible is now in a position more forward in relation to the plane NA than it was before treatment.

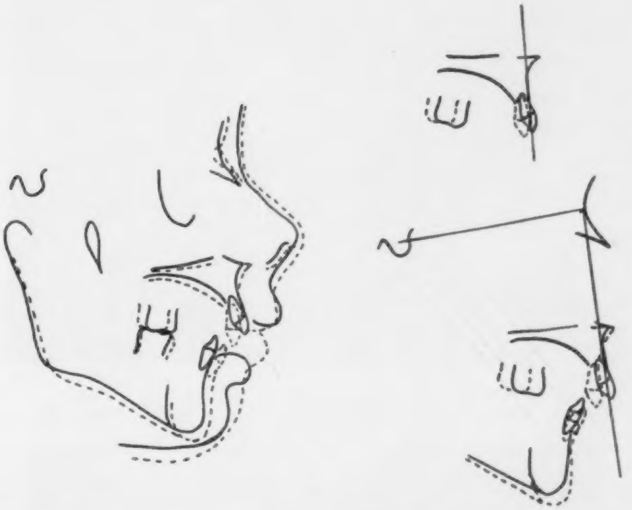

Fig. 2.—The broken line indicates extremely favorable mandibular growth, while distal movement in the maxilla is not as spectacular as previously shown.

The angle SNB has improved 2 degrees, while the angle SNA has remained unchanged, making a net change of 2 degrees. The upper second deciduous molars have been moved 3 mm. distally, as have the deciduous incisors. The 2 degree change in position of the mandible represents a distance of 3 mm. The situation here is almost opposite to what we found in the first case. Which type of change is more desirable? My preference, if a choice were available, would be the latter.

These two cases have been types in which we can see definite improvement for the patient and determine to a degree how this improvement came about.

Not all of the cases responded in such a clear-cut manner. Sometimes the changes were subtle and more difficult to pick out, and yet the patient showed some improvement. The next illustration cannot be called a typical response, and yet one sees it. Fig. 3 indicates that there is very little happening during treatment, except tooth movement. The interval between the two headfilms is one year. You will notice in the over-all picture that point N has come forward

slightly, the anterior portion of the maxilla has straightened out with the uprighting of the incisor, and the mandible remains about the same with a slight increase in the mandibular plane angle. This was not associated with the use of intermaxillary elastics.

In checking for maxillary change we see that the incisors and point A have moved somewhat distally. It should be noted that the movement of the incisors here and in most of the cases was generally bodily movement rather than tipping. The change in the molar area has been about 1.5 mm.

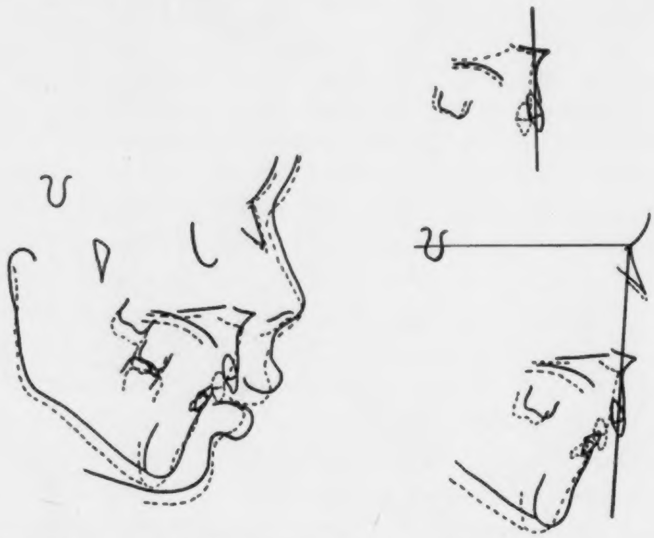

Fig. 3.—The broken line indicates changes which have taken place in a patient with an unfavorable facial growth.

In the mandible, point B has moved distally with the increase of the mandibular plane and gives no help in our attempt to establish better facial balance. The move in the direction of better balance in one arch has been canceled out by the move away from improvement in the other. The patient's condition is improved mainly as a result of change of tooth position and not as a result of a favorable change in relationship of parts due to growth. The vertical growth and incisor movement account for the relieving of some of the fullness in the upper lip area.

There does not seem to be any way of knowing what sort of response we can expect. Some cases seemingly respond better than others, but how does one evaluate this before treatment begins? We cannot expect, in approximately one year's time, to have an extreme condition turn into a normal one, but we are gratified when we see reasonable improvement. Most of these patients showed a definite improvement in relationship of facial parts after treatment. This last one was probably the least satisfactory result and yet some improvement cannot be denied. When the response is favorable, as it was in most of these cases, then treatment in the deciduous dentition for improvement of arch and tooth relationship does not seem contraindicated.

The average amount of distal movement of maxillary second deciduous molars in relation to the plane NA in these cases was approximately 4 mm. This change was due to a combination of both tipping and bodily movement. In two of the cases there was some evidence of resorption on the distal root of the second deciduous molars, and it appeared as though the permanent molars might have some difficulty erupting into normal position. In the other cases there did not appear to be any barrier to normal eruption. This resorption could be attributed to an anatomic variation in position of the permanent molar which we see in untreated cases and which is described as an ectopic eruption of molars.

Fig. 4.—Normal position for first permanent molar bud at the age of 3½ years.

Fig. 5.—Permanent molar bud more mesial than normal.

If our developing molar bud is in the position seen in Fig. 4, which is considered normal at about 3½ years of age, then in all probability we will have no difficulty when the tooth erupts. The crown is in a slightly distal angulation, and it would be difficult to change its position by distal movement

of molars. It can be pushed distally, but not easily rotated. If, on the other hand, at a comparable age it is in this more mesial relation to the second deciduous molar (Fig. 5), we can see where possibly any tooth tipping during distal movement might create a problem as far as the eruption of the permanent molar is concerned. Even with no treatment, we can visualize a problem in its normal eruption. Treatmentwise, in the latter case, I would suspect that a period of waiting until the permanent molar had erupted further might be in order, if complications were to be avoided. I do not think it would be necessary to wait for the complete eruption of the tooth, but only until it seemed fairly certain that it would not lock under the deciduous molar.

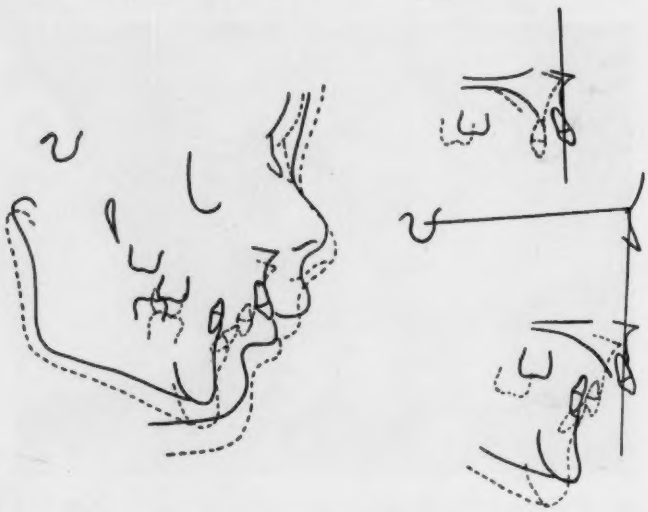

Fig. 6.—Broken line showing change in position of lower molar and incisor illustrates loss of anchorage.

As the upper incisors were moved lingually, their permanent successors preceded them and became more erect in the crypt. The average amount of distal movement was 7 mm. Some of the permanent incisors appeared as though they might be more upright than normal when they erupted. It was not possible to determine from the headfilms whether or not the movement of the deciduous incisors would have any rotational or crowding effect on the permanent successors.

In the cases in which intermaxillary elastics were used, anchorage was something that had to be watched. In one case, for example (Fig. 6), where a lower lingual arch was used for anchorage and light intermaxillary elastics were worn for four months in conjunction with a maxillary headgear, the lower incisors had tipped forward and, while it is not specifically demonstrated here, a superposition of tracings of the mandible would show that the molars have also come forward. There was some evidence of tooth tipping in all the cases in which this type of anchorage was utilized.

In this group of patients, success with the overbite problem was considered not better than fair. Some of the cases seemed to be improved, but generally it should not be considered one of the prime benefits of treatment.

SUMMARY

The changes in mandibular position were not seen as frequently as I had thought they would be. The actual amount of forward positioning of the mandible through growth was at about the same rate as the increase in the length of the line SN. I had anticipated more mandibular repositioning or adjustment than was demonstrated.

On the other hand, the amount of change and distal positioning of the alveolar portion of the maxilla was something that had not been anticipated. The change in tooth position, yes, but the alteration in the position of point A not to the extent the headfilms disclosed. I have spoken before in terms of retarding the forward positioning of the maxilla—or slowing down the growth—but in these very young patients one seems to get all of that and then some more.

It should be emphasized that the treatment time in these cases was about one year. In extreme malocclusions we cannot reasonably expect complete correction of a malrelationship of facial parts in this relatively short period of time. Our basic aim is improvement of jaw relationship so that later on we will not be called upon to treat a condition which, from a standpoint of balance and harmony, stands little chance of real correction.

These findings will be more valuable when we can secure additional records on these patients as their dentures continue to develop. We will then have more substantial evidence as to the real amount of help early treatment can bring. Until then, I think that these tracings are worth thinking about.

CONCLUSIONS

Treatment is beneficial in adjusting anteroposterior discrepancies in extreme Class II, Division 1 malocclusions when they are treated in the deciduous dentition.

Most of the changes will occur through alteration in the anterior portion of the maxilla and associated with distal movement of the teeth in this arch.

Mandibular growth cannot be counted on as an ally in the treatment of these cases.

Intermaxillary elastics can cause forward tipping of teeth in the lower arch, which may be undesirable.

Distal movement of the maxillary teeth is best accomplished by use of occipital anchorage.

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760 Market St.

Orthodontic Profiles

GEORGE WELLINGTON GRIEVE

ON A bleak and bitterly cold February morning in 1884, a boy trudged along the snow-banked country roads outside Cobourg, Ontario. With him he carried his worldly possessions: two suits of clothes, both of which he wore, and $2.00, a financial stake unofficially "borrowed" a few hours before.

He was running away. This was not his first attempt but this time he was to succeed in taking the first step to a new life, a life which would eventually lead him to the title of Dean of Canadian Orthodontists, and to a long and distinguished career in dentistry.

George Wellington Grieve was born on Sept. 18, 1870, of predominatly Scottish ancestry. When he was only 8 years old, he was left an orphan, entrusted to the care of relatives on a farm near his native town of Cobourg. About a year later his foster-mother died, and a grown daughter became head of the home. She was often unkind to the boy, and the four or five years before the eventful February morning were unhappy ones for him. So, barely past 13 years of age, he found his way back to the town and set about the business of job-seeking.

A door-to-door canvass of the shops on Main Street brought him his first paying job, a chance to learn the printing trade as an apprentice at the princely salary of $1.50 a week. Board and lodging took the wage as quickly as it came, and the boy sold Toronto papers on the street in the evening, picking up whatever other odd jobs he could to supplement his earnings.

From the Cobourg newspaper office he went to Owen Sound where he lived for three years, working in the slack summer season as a waiter on the Great Lakes steamers. Finally, at the age of 20, he moved to Toronto, where he was employed by the Toronto *Globe,* and learned to operate the type-setting machine, an innovation in the newspaper world of 1890. This employment led, in turn, to a better position with the Montreal *Star* as a linotype machinist.

For some time the inadequacy of his educational background had troubled him, and in Toronto he began the long, arduous and demanding process of making up these deficiencies by attending night school while still working a full day. Always tenacious of purpose, he completed his matriculation in this manner, and in 1897 returned to Toronto to begin the study of his chosen profession. The choice of a career had been a carefully determined one for George Grieve, and no member of the 1899 graduating class of the Royal College of Dental Surgeons could have faced his new career more proudly than he.

For almost eight years he worked in general practice with Dr. Bruce Nichols. But a new direction was pointed out to the ambitious young Dr. Grieve when he happened to attend a session of the Ontario Dental Association, where he heard an address by Dr. Edward H. Angle, the noted head of the Angle School of Orthodontia in St. Louis. Dr. Angle's forceful presentation stimulated the young dentist to further his personal knowledge by enrolling in Dr. Angle's school. Consequently, in 1907 he went to St. Louis and was graduated from the Angle School the following year. Now he returned to Toronto once more, this time as a specialist in orthodontics, establishing a practice in an office located at Bloor and Yonge Streets in the heart of the growing Canadian metropolis.

GEORGE WELLINGTON GRIEVE

A precision workman, whose enthusiasm for his profession went far beyond daily attention to his patients, Dr. Grieve soon became recognized as outstanding in his field. In 1915 he was chosen president of the Toronto Dental Society, and in the same year began a three-year period as an associate professor of Orthodontia at the Royal College of Dental Surgeons. It was during this period, also, that he married Mildred C. Allen of Toronto.

In 1920, after careful preliminary study and investigation, he was ready to throw the weight of his conviction behind the necessity for the extraction of four dental units in definitely determined cases as a preliminary to undertaking certain types of treatment in cases of crowded dental arches. This procedure has, of course, now been generally accepted, and is taught in most dental schools. At that time, however, the proposition of such a theory was a step requiring considerable courage. In doing so, he was opposing his old teacher and respected leader, Dr. Angle, and he realized that he must be prepared to withstand considerable opposition, even open hostility, on the part of his colleagues. But one of my most vivid memories of Dr. Grieve is seeing his delight on those occasions when he could, possibly at Association meetings, gather around him experts who held different opinions and engage them in informal debate. I have no doubt that the stronger the opposition to his new theory, the more keenly he entered into enthusiastic defense of, and proofs for, the theory in which he believed.

His was a pioneer spirit looking forward to new advancement in the skills of his profession, and he was never known to hesitate in helping a colleague where he could be helped. It was my privilege on many occasions to be permitted to sit with him informally and discuss cases presenting unusual problems; in such instances he gave unselfishly and enthusiastically of his time, knowledge, and foresight. Throughout the years his office became a Mecca for visiting orthodontists, and "Scotty," as he was known to intimate friends, had a marked influence on the profession which cannot be measured in words. Consequently, his was the most popular of awards when, in 1940, he was the recipient of the Albert H. Ketchum Memorial Award for his outstanding contribution to his profession.

Recognition of his place in the history of orthodontics came to Dr. Grieve in many forms and from many lands. In 1931 he was chosen Honorary Vice-President of the World Orthodontic Congress in London, England, and he held various executive offices in the professional associations in which he was an active member for over thirty years. These included the Toronto Academy of Dentistry, the Ontario Dental Association, the Canadian Dental Association, and the Eastern Association of the Angle School of Orthodontists. He was eagerly sought after for addresses at orthodontic meetings, and appeared internationally at orthodontic congresses in New York, London, and Zürich.

Voluminous printed records in the orthodontic literature are a silent testimonial to his inquiring mind, scientific skill, and ardent enthusiasm for his work. He also found time to be active in public health education activities in his own community, being for many years chairman of the Education Committee of the Canadian Oral Prophylactic Association. He was one of the founders of this organization, and also of the Canadian Dental Hygiene Council.

In describing such a man, who finds his happiness in his work, it is difficult to draw a line and say, "This was his work, this his pleasure." In an attempt to complete the picture of the man, however, let us not omit his delight in a fishing trip, or the enthusiasm which he displayed as a bowler or on the golf course.

His retirement from active practice in 1946 left a gap in the profession which could not be easily filled. His death, on Jan. 2, 1950, was mourned internationally by the friends who were his colleagues and by the colleagues who will remember him not only for his professional skills, but as a man of integrity, modesty, and sincerity whose basic honesty was such that he would brook no compromise with what he believed to be the truth.

—*G. Vernon Fisk.*

Report

EDITOR'S REPORT ON THE AMERICAN JOURNAL OF ORTHODONTICS, 1957

A REVIEW of the reports of the editor as presented each year reveals that the subject of the cost of illustrations for publication always takes up several paragraphs of the report.

There is good reason for that situation as it is to be recalled that a $3,000.00 ceiling is placed on the editor for the expense of illustrations each year. This item is fixed by contract inasmuch as The C. V. Mosby Company pays this illustration item. It is to be remembered that orthodontic manuscript, being of the character it is, lends itself to overillustration and that fact alone makes for expense unlimited unless a ceiling is placed on it.

The Editorial and Publication Board partly answered this problem by providing the following directive:

> "Many valuable articles are lost for publication because they were not prepared for publication; therefore, they must be properly prepared, otherwise they are not suitable for publication."

Inspired by the above circumstances, the editor compiled comprehensive instructions for preparing manuscript for publication in the JOURNAL. These instructions were published in the JOURNAL in January, 1956, and then subsequent reprints were obtained. Wherever possible since that time, the editor has placed one of these reprints in the hands of prospective authors. This action has proved to be of great benefit and has saved much lost motion in the preparation of manuscripts for publication in the JOURNAL.

Other things have happened during the last few years. We now have our secretary, Dr. Shepard, doubling as Assistant Editor. Dr. J. A. Salzmann, our Abstract Editor for many years, now serves with editorial status. These circumstances now place the JOURNAL in a much more secure position and provide more security for the subscribers in the event of sickness or other hazards of the Editor-in-Chief.

Members of the Publication Board, as usual, have been quite active, particularly Dr. Leigh Fairbank and Dr. Joseph D. Eby. Both of these men have been most energetic, loyal, and cooperative in helping to make this JOURNAL a success and continuing its record of publication throughout a period of forty-three consecutive years without ever missing a single month of publication. During that time a grand total of 504 complete issues have gone to press.

There was ample material available during 1956. What with much of the manuscript of the American Association of Orthodontists and the sectional societies available, as well as some material from the American Board of Orthodontics, there has been opportunity for closer selection of material. The availability of manuscript is always a matter of concern. For instance in periods of war, manuscripts become scanty and hard to get, and in peace the problem works in reverse. It is necessary to "beat the brush" to secure the kind of manuscript that is desired for the AMERICAN JOURNAL OF ORTHODONTICS during certain periods of time, particularly war periods.

Your editor was recently alerted by a member of the Publication Board as to "why we do not have what is known as a policy for the Journal." Your editor promptly replied that the policy of the JOURNAL was published in Jan. 1, 1915, in Volume 1, No. 1. The thought then occurred to me that perhaps, inasmuch as years have elapsed since 1915, it is reasonable to suppose that there are many then who may not have read the policy of the JOURNAL. Your editor, therefore, decided to include the policy as written in an editorial, Jan. 1, 1915. It was written by the first editor of the JOURNAL, Martin E. Dewey.

THE EDITORAL POLICY OF THE JOURNAL

Of course our readers and contributors will be interested in knowing something of our policy. Briefly, we want to state that the Journal will be conducted for the benefit of orthodontia as a science and as a specialty. To this end we will strive to publish articles that will be of interest to the entire orthodontic fraternity. We will endeavor to secure contributions of merit from workers in the field of orthodontia and its closely allied specialties regardless of "race, color, or previous conditions of servitude."

It is our intention when publishing articles dealing with appliances and methods of treatment to describe only such appliances and those forms of treatment that have proven their worth in the hands of responsible practitioners.

On account of the diversity of opinion with reference to "nomenclature," articles will be published with whatever form of nomenclature the writer desires to use, but such use does not imply that the editor agrees with the views of the author.

The pages of the Journal will always be open for the discussion, in a scientific manner, of disputed points in orthodontia.

It shall be our constant endeavor to secure original contributions on subjects of interest to our readers and the proceedings of those societies that in our opinion can best be served by publication in this Journal.

We hope through this policy to serve at all times the greatest number and to help make orthodontia the science we have long hoped it would be.

Martin Dewey.

In addition to the original policy, there was an editorial written at that time called "The Journal's Endeavor," excerpts from which follow:

THE JOURNAL'S ENDEAVOR

Service is man's greatest gift to society, and in proportion to the service which we render to our fellow-man, is our value to the world. The purpose of The International Journal of Orthodontia will be to serve humanity, and this service will be rendered to the very best of our ability. Efficiency is the cry of the twentieth century. How to make two blades of grass grow today where only one grew yesterday is the constant endeavor of our most thoughtful men. How to overcome mouth and jaw defects in the child and thus assist in developing more efficient manhood and womanhood is the purpose of the orthodontist. To aid in this shall ever be the purpse of this journal. . . .

Preventive medicine is the slogan today of scientific medicine. To cut down the waste occasioned by disease is the endeavor of our great medical universities, backed by endowments of millions of dollars, the gift of the state or philanthropic individuals. Lengthen the human span and increase man's physical ability to cope with the natural handicaps. To this laudable purpose we subscribe heartily and join with it in an endeavor to start the young on life's journey with teeth in normal occlusion, thus enabling them to properly breathe and masticate their food. . . .

The International Journal of Orthodontia will endeavor to serve society by arousing interest in this much-needed and fascinating branch of science. It offers its pages to workers in this field with the hope that it may benefit humanity, that it may help to increase human efficiency, and that it may become a factor in arousing interest in our child-life to such an extent that malocclusion be given as much attention as is now bestowed by school inspectors upon adenoids, eyestrain and mental defects.

Charles V. Mosby, M.D.

This report is submitted with the thought in mind that the financial and business matters pertaining to the JOURNAL are covered by the report of the Chairman of the Publication Board, Dr. Leigh C. Fairbank. It is submitted with the assurance that the new contract signed with The C. V. Mosby Company in 1956 for the publication of the JOURNAL and that the proposed new By-laws pertaining to the publication and operation are covered in the report of the Publication Board.

Respectfully submitted,

H. C. POLLOCK, Editor-in-Chief.

In Memoriam

WILLIAM R. DINHAM
1887-1957

WILLIAM R. DINHAM, one of the first orthodontic specialists in the Northwest, died July 6, 1957, after a long illness.

Dr. Dinham was born in Duluth, Minnesota, in 1887. He graduated from North Pacific Dental College in 1913. After one year of general practice, his heart was set on an orthodontic career. His first training was at the Dewey School in New York; throughout his career his meticulosity and self-criticism never let him quit studying. He worked and gained friendship with most of the leaders in orthodontics.

Probably his greatest contribution was in his aid and guidance to younger men entering orthodontics. In them he has left a lasting memorial of professional integrity which they in turn will pass on.

Dr. Dinham was a past president of the Portland District Dental Society, the Pacific Coast Society of Orthodontics, the North West Conference of Dental Medicine, a member of the Angle Society and the Tweed Foundation for Orthodontic Research, American College of Dentists, and a diplomate of the American Board of Orthodontics.

He is survived by his wife, Quinna; a son, Dr. Richard Dinham, Honolulu; a brother, Dr. George Dinham, Duluth, Minnesota; and one granddaughter, Elizabeth Dinham.

Our progress as a profession is due to men of his caliber.

Denton J. Rees.

Department of Orthodontic Abstracts and Reviews

Edited by
Dr. J. A. Salzmann, New York City

All communications concerning further information about abstracted material and the acceptance of articles or books for consideration in this department should be addressed to Dr. J. A. Salzmann, 654 Madison Avenue, New York City

Aspects of the Transition From Deciduous to Permanent Dentition. By Eileen M. E. Bonnar, *D. Practitioner* **7**: 42-54, October, 1956.

This paper deals with the occlusal changes affecting buccal segment relationships which take place prior to and during the changeover from deciduous to permanent incisors.

The limits of space within which the incisors can arrange themselves are determined by the deciduous canines, which are not due for replacement until long after the establishment of the permanent incisors. Since the latter are always larger than the deciduous incisors, this makes them dependent for regular alignment on growth, and the timing of growth, to an extent which does not apply to any other teeth, except possibly the third molars. The incisors always go through a stage of crowding before eruption, due to their crowns achieving full size at an early stage of jaw growth. From the point of view of the practice of orthodontics, problems arise from the fact that malocclusions are most commonly seen when the full upper-lower incisor relationship has been established. The closeness of that relationship frequently creates an impression that it is due to the interaction of the two groups, but it is not established that this is the case. There is the alternative possibility that the malpositions which lead to the malocclusions of the teeth are established, wholly or in part, before eruption.

The changes which Friel found taking place after the complete eruption of the deciduous teeth and before the complete eruption of the permanent teeth were:

> "1. Slight forward growth of the anterior portion of the mandibular deciduous arch, but mainly lateral growth of the whole arch to accommodate the mandibular permanent incisors.
>
> "2. Slight forward growth of the anterior portion of the maxillary deciduous arch, but mainly lateral growth of whole arch to accommodate the maxillary permanent incisors.
>
> "3. Forward growth of mandibular arch to compensate for greater increase in size of maxillary arch.
>
> "4. Labial inclination of permanent incisors, especially the maxillary incisors.
>
> "5. Forward movement of maxillary and mandibular first permanent molars after the loss of the second deciduous molars."

Stone-plaster models were made from impressions of the teeth taken in Zelex or Parabar. In selecting the children, the only requirements were that

the complete deciduous dentition should be present and that the children should be available for inspections and impressions over a period of five to six years, or at least until the permanent incisors were fully erupted.

There were ninety-three children, for fifty-eight of whom there are records from the completed deciduous dentition to the full eruption of the permanent incisors.

Variation in the pattern of development is the outstanding feature. The principal varieties of change are as follows:

1. A forward relationship of the lower arch to the upper arch may be established at the completion of the deciduous dentition.
2. Forward movement of the lower arch relative to the upper may occur in the intact deciduous dentition.
3. Forward movement of the lower arch relative to the upper may occur just prior to or during the eruption of the first permanent molars.
4. Forward movement of the lower arch relative to the upper may occur at the time of eruption of the lower permanent incisors.
5. There may be a difference in the behavior of the buccal segments in the two sides.
6. No change in the arch relationship may occur up to the end of the period studied.
7. Changes in the arch relationship are most likely to take place in conjunction with eruption of teeth.

Contrary to Baume, it was found that forward movement of the lower arch relative to the upper in the deciduous dentition definitely does take place, that the "canine axis," as he calls it, changes. This forward movement can be independent of the closure of spaces. Where there are spaces these are seen to be reduced, if not closed altogether, before or during the eruption of the first permanent molars. Closure of spaces is often the first stage of forward movement of the lower buccal teeth, to be followed later by further movement of the whole buccal segment or segments.

Marked forward movement of the lower arch takes place at the time of eruption of the lower permanent incisors and, more especially, the lower lateral incisors. This cannot be accounted for by the closure of spaces, as in most of the cases there were no spaces to close.

There may be forward movement of the lower buccal segments on both sides at the same stage, but the degree of movement may vary; for example, one side may move forward more than the other at one period, while the reverse takes place at a later period. It is the exception, rather than the rule, to find symmetrical movements taking place on both sides to the same extent. One cannot, therefore, predict what the occlusion of the permanent dentition will be until all the deciduous teeth have been replaced.

Forward movement of the lower arch takes place principally at the times of eruption of teeth. There are three main stages:

1. Immediately prior to and during the eruption of the deciduous molars.
2. Immediately prior to and during the eruption of the first permanent molars.
3. Immediately prior to and during the eruption of the lower permanent incisors and especially the lower lateral incisors.

In a small number of cases the lower arch also moves forward between the completion of the deciduous dentition and the eruption of the first permanent molars, as described by Friel and Clinch. There is also the forward movement of the permanent molars that takes place following the eruption of the premolars, although this is more of a forward drift, using up the extra space. The greatest impetus to forward growth of the lower arch seems to coincide with the times of eruption of the deciduous second molars, the first permanent molars, and the lower permanent incisors.

Changes which occur during development of the anteroposterior relationship of the dental arches can arise as follows:

1. The normal relationship of the lower arch to the upper arch may be established at the completion of the deciduous dentition, negligible changes thereafter taking place.

2. If the lower arch has not moved forward, as in (1), it may do so before the first permanent molar erupts, so that the tip of the mesiobuccal cusp of the upper molar occludes slightly mesial to the buccal groove of the lower molar.

3. Where the forward movement in (2) has not taken place, the lower teeth may move forward just prior to and during the eruption of the first permanent molars. The tip of the mesiobuccal cusp of the upper tooth then, as before, occludes just mesial to the buccal groove of the lower molar.

4. Where neither the forward movements of (2) or (3) have taken place, so that the first permanent molars erupt in the cusp/cusp relationship, this may be only a transitory stage. The lower arch may move forward when the lower permanent incisors erupt, so that the normal relationship is established then.

5. There is the forward drifting of the upper and lower permanent molars that takes place when the premolars erupt. As the lower moves a little more than the upper, final adjustments can then take place.

6. The upper and lower buccal segments on either side move independently of each other.

Abstracts Presented Before the Research Section of the American Association of Orthodontists, New Orleans, May, 1957

Estimation of the Sum of the Widths of Unerupted Mandibular Cuspid, First Bicuspid, and Second Bicuspid: By Richard H. Oldfather, D.D.S., M.A., State University of Iowa, Iowa City, Iowa.

The purpose of this investigation was to find a more efficient method for predicting the combined mesiodistal widths of the unerupted cuspid, first bicuspid, and second bicuspid in the mandibular arch. In a sample of forty-one cases, the mesiodistal widths of individual teeth were measured on dental casts and intraoral x-ray films. The x-ray films were taken with a 16 inch cone.

Twelve different methods for estimating the combined mesiodistal widths of the cuspid, first bicuspid, and second bicuspid in the mandibular arch were considered. Of these, the most efficient was a method of prediction based on the combination of the combined mesiodistal widths of the first and

second bicuspids measured on the x-ray film, plus the combined mesiodistal widths of the central and lateral incisors measured on the dental cast.

This combination, when correlated with the sum of the mesiodistal widths of the cuspid, first bicuspid, and second bicuspid measured on the cast, gave a correlation coefficient of $\underline{r} = 0.88$. The predictive formula based on this relationship is: $Y = 2.41\bar{2} + 0.682X$. The standard error of estimate for this predictive formula is 0.55 mm.

This method of prediction is 25 per cent more efficient than the current methods used, which are based on the relationship between the combined mesiodistal widths of the four mandibular incisors and the combined mesiodistal widths of the cuspid, first bicuspid, and second bicuspid.

A Comparison of the Gnatho-Thesiometer With Lateral Cephalometric and Temporomandibular Joint Radiographs in Measuring Certain Anteroposterior Positions of the Mandible: By Robert G. Yahr, D.D.S., M.S.D., Northwestern University Dental School, Chicago, Illinois.

Eight subjects possessing excellent occlusions of the teeth were used to compare certain anteroposterior positions of the mandible by three methods: the gnatho-thesiometer, lateral cephalometric radiographs, and temporomandibular joint radiographs. Three points of the mandible (an anterior point and two condylar points) were recorded in these comparisons.

The gnatho-thesiometer is a measuring instrument devised to register primarily the contact positions of the mandible in persons with natural teeth. It is unique in that it consists of a movable, inverted model of the mandibular teeth with a shaft to represent the condylar points and a likewise inverted, but fixed, model of the maxillary teeth. Measurements of the three main points can be recorded directly from the apparatus in the three planes of space.

In order to compare the three methods, four occlusal positions in the anteroposterior plane were selected: the extreme retruded occlusal position, median occlusal position, incisal occlusal position, and the extreme protruded position. These positions were controlled by the use of wax records, so that the same positions could be duplicated in each of the three methods.

Measurements were read directly from the gnatho-thesiometer, whereas composite tracings of the lateral cephalometric and temporomandibular joint radiographs were necessary before graphing the results for a comparative analysis.

SUMMARY

1. The anterior measuring point, compared by the gnatho-thesiometer and lateral cephalometric radiographs, showed an excellent agreement within about 0.5 mm.

2. A comparison of the right and left condylar points, by the gnatho-thesiometer and temporomandibular joint radiographs, was considered good inasmuch as different reference planes and other uncontrollable factors in the method were used.

3. The anterior measuring point showed a retrusive range from 0.5 mm. to 1.5 mm. between the median occlusal position and the extreme retruded occlusal position. In some instances, this retrusive range could not be measured at the condyle on the temporomandibular joint radiographs, whereas it was slightly more discernible on the gnatho-thesiometer.

An Electromyographical Investigation of Postural Position of the Mandible: By Ronald P. Mullen, B.A., D.D.S., M.S.D., Northwestern University Dental School, Chicago, Illinois.

The purpose of the investigation was, first, to attempt to utilize the electromyograph in determining rest or postural position of the mandible and, second, to check the reliability of the electromyograph in determining postural position and the feasibility of using lateral cephalometric radiographs to register postural position of the mandible.

An electromyograph to record minute action potentials associated with minimum muscular activity, a Steiner head positioner to insure constant head position, and an x-ray machine to register postural position of the mandible with lateral cephalometric radiographs were utilized in the study.

Seventy-five subjects were used, regardless of type of occlusion of the teeth, presence of temporomandibular joint disturbances, muscular aberrations or age. Two identical electromyograms of minimum muscular activity associated with postural position of the mandible were recorded from the masseter, anterior temporal, and suprahyoid muscle areas. Coincidentally with these postural positions, lateral cephalometric radiographs were taken. These radiographs were measured to evaluate the reliability of the electromyograph in determining postural position of the mandible. The radiographs were also evaluated as being a suitable means to register postural position.

The results have shown the electromyograph to be reliable. The mean difference in postural positions for the group was 0.333 mm. Thirty subjects had identical postural positions and sixty-eight of the seventy-five subjects had postural position differences of 1 mm. or less.

The observations and conclusions were:

1. It has been found possible to record evidence of electrical activity coincident with postural position of the mandible. The electromyograph records this electrical activity reliably.
2. It is feasible to use lateral cephalometric radiographs to register postural position in conjunction with the electromyograph.
3. The electromyograph must be organized to record minimum muscular activity associated with postural position of the mandible.
4. It is probable that higher centers affect postural position.
5. The electromyograph determines postural position in three spatial planes, laterally, vertically, retrusively, and protrusively.
6. When one muscle of the group determining postural position shows minimum muscular activity, the others also show minimum muscular activity.

An Electromyographic and Cephalometric Roentgenographic Study of Rest Position of the Mandible and the Interocclusal Clearance: By Alexander J. Javois, D.D.S., Northwestern University Dental School, Chicago, Illinois.

This investigation has utilized the electromyograph to record minute action potentials from muscles in human subjects. Electrical activity varying from 3 to slightly more than 30 microvolts has been demonstrated in apparently resting muscles. It is believed that this activity represents the contraction of the muscles necessary to maintain posture.

While minimum electrical activity from certain mandibular muscles was recorded electromyographically, an oriented cephalometric roentgenogram was taken. By comparing this radiograph with one taken with the teeth in occlusal position, it was possible to determine the interocclusal clearance. Statistical correlations were computed for the interocclusal clearance dimensions and various skeletal measurements.

From the results of this study, the following conclusions were made: (1) A low level of activity may be recorded electromyographically from muscles which are presumably maintaining posture; (2) rest position of the mandible may be established by cephalometric roentgenography; (3) there is a significant, positive correlation between the anterior and posterior vertical dimensions of the interocclusal clearance; (4) there is a probable negative correlation between the posterior vertical dimension of the interocclusal clearance and the posterior face height; and (5) for the subjects studied, no other significant correlations were found between either size or pattern of the interocclusal clearance and the various facial skeletal factors considered.

A Radiographic Study of the Temporomandibular Joint in Children Possessing a Severe Sagittal Maxillary-Mandibular Dysplasia: By John Burt Hazle, Jr., D.D.S., M.S.D., Northwestern University, Chicago, Illinois.

This investigation was directed to studying the morphologic and functional characteristics of the temporomandibular joint of a group of children possessing a severe sagittal maxillary-mandibular dysplasia and to finding what differences might be noted when this group was compared with a previously evaluated group of children having excellent anatomic and functional occlusions.

Thirty subjects between the ages of 7 years 7 months and 12 years 7 months were selected. The mean age was 10.19 years. The basis of their selection was that they possess a SNa-SNb difference of 6 degress or more.

The collection of data was divided into two parts: first, a clinical examination and, second, a radiographic examination. The radiographic examination consisted of two series. One series was a lateral cephalometric group taken by using the Broadbent-Bolton cephalometer. The positions recorded were: rest position, occlusal position, incision position, and an open-mouth position. The temporomandibular joint radiographs were taken with the Donovan orienting device. The following positions were recorded: rest, occlusion, incision, and retrusion.

Composite tracings of both radiographic series were made and measured for each subject. The overjet and overbite were noted. The mean overjet was 10.38 mm., and the mean overbite was 5.17 mm. The results were analyzed and means, standard deviations, standard errors, and coefficients of variation were determined for forty-nine measurements. This group was then compared with the normal group by means of the "t" ratio. The following differences between the two groups' means were noted:

1. The condyle center of both groups (Anderson's normal group and the dysplasia group) is in the same skeletal relation in rest, occlusion, and retrusion.
2. At the incision position, the condyle center point of the dysplasia group is in a more anterior and inferior position.
3. The distance traveled by the condyle center point of the group possessing the dysplasia in the vertical and horizontal planes is larger in the movements from rest to incision and occlusion to incision. The dysplasia group displays a greater movement in the horizontal plane in the movement from occlusion to retrusion.
4. The movement of the condyle center point of the dysplasia group, without regard to base lines, is greater in the movements from rest to incision, occlusion to incision, and occlusion to retrusion.

5. The interocclusal clearance (freeway space) of the group displaying the dysplasia is greater.
6. The fossa depth point of the dysplasia group is more posterior, and the eminence height point of this group is more inferior.
7. The incisor path in the movement from occlusion to incision is more horizontal in the group possessing the dysplasia, due to the large overjet present.
8. The condyle path displayed by the dysplasia group in the movement from rest to incision is in a more horizontal plane because of the large overjet.

A Comparative Study of Movement of the Mandible as Recorded by Cephalometric Radiography and the Gnatho-Thesiometer: By William J. Bryan, D.D.S., M.S.D., Northwestern University, Chicago, Illinois.

The prime object in this study was to compare the movements of the mandible from rest to the median occlusal position as recorded by lateral cephalometric radiographs and Posselt's gnatho-thesiometer. The gnatho-thesiometer permits measurements of differences in positions between various positions of the mandible as measured at three points, namely, the condylar shaft points and the anterior measuring point, corresponding to the radiographic landmark, infradentale.

The subjects used in this study were eight adults, all considered to have excellent anatomic and physiologic dental occlusions.

The data were obtained by taking wax records of the median occlusal position and plaster cores of physiologic rest position. Each record was read on the gnatho-thesiometer and then placed in the mouth to secure radiographic registration of the same positions. An open-mouth radiograph was also taken to use as a template of the mandible. A master tracing was then made showing the relative position of the mandible in both the median occlusal and rest positions. The mandibular movement recorded at the condylar and infradentale points, between these two positions, was measured and compared to the results obtained by reading the gnatho-thesiometer in the same two positions. Various tests were carried out on the gnatho-thesiometer to test its validity and it proved to be very accurate.

SUMMARY

1. The use of the gnatho-thesiometer as a means of recording the movement of the mandible from rest to the median occlusal position is accurate within 0.5 mm.

2. The movement of the mandible from rest to the median occlusal position, as recorded by both the gnatho-thesiometer and lateral cephalometric radiographs, was primarily a hinge movement with an apparent slight amount of translation.

3. The movement of the mandible from rest to the median occlusal position, as recorded by the gnatho-thesiometer and lateral cephalometric radiographs, was observed to be identical.

A Method Study of the Northwestern Stereocephalometer: By Herbert L. Bloom, Jr., D.D.S., M.S.D., Northwestern University, Chicago, Illinois.

The purpose of this study was:

1. To determine the amount of enlargement and degree of magnification distortion of radiographs taken with the Northwestern stereocephalostat.

2. To determine the effectiveness of the Lysholm wafer grid when used for cephalometric radiographs with the Northwestern stereocephalostat.
3. To develop a technique for producing the best possible radiographs with the Northwestern stereocephalostat.

Grids constructed of punched steel plate were used to study enlargement. The grid squares were 5 mm. square and the lines were 1.4 mm. wide. Radiographs of these grids showed the approximate enlargement of midline structures using the stereocephalometer to be 11 per cent, compared to 7.5 per cent when using the Bolton cephalometer. Lateral structures were enlarged between 6 per cent and 16 per cent with the stereocephalometer, while the Bolton cephalometer showed enlargement between 4.4 per cent and 10 per cent for similar structures.

Enlargement was found to be uniform throughout the radiograph with both the stereocephalometer and the Bolton cephalometer, eliminating a need for correction tables. Correction may be made for linear measurements of midline structures by using a simple mathematical percentage. Thus, enlargement within reason is not a significant factor in orthodontic measurements and diagnosis.

To determine the effect of the Lysholm wafer grid radiographs of patients, made with and without grid, were studied by ten qualified observers. The conclusions were that the Lysholm wafer grid improves detail of soft and hard tissue, whether structures are large or minute. Even more important, it improves the contrast of radiographs when a high-voltage technique is used.

In developing a technique for producing the best possible radiographs using the stereocephalostat, sixty-five patients were used and approximately 400 cephalometric radiographs were taken, developed, and studied. The stereocephalostat uses the General Electric KX-22 x-ray unit and LWRT Coolidge rotating anode tube.

There are three areas of the skull, each of which requires different exposure quantities—the cranium, the face, and the soft tissue. For optimum results in each area, some type of compensation is necessary to overcome the necessityy of three separate exposures of each area.

Aluminum filters and reducing techniques were tried but were not effective enough to warrant their use. Slight overexposure and an observational development technique is the most effective method of producing the best radiographs. Barium paste used to outline the profile acts as a valuable adjunct to the technique.

A Gnatho-Thesiometric Study of Various Mandibular Positions in Individuals With Normal and Abnormal Function of the Temporomandibular Joints: By Ben J. Addiege, D.D.S., M.S.D., Northwestern University Dental School, Chicago, Illinois.

This investigation was undertaken to compare various occlusal contact positions and their associated condylar movements in persons with normally and abnormally functioning temporomandibular joints.

Two groups, each consisting of eight persons, were selected for comparison. The "normal" group was composed of subjects exhibiting excellent anatomic and physiologic dental occlusions and normal function of the temporomandibular joints. The "abnormal" group consisted of subjects exhibiting clinically abnormal function of the temporomandibular joints.

The occlusal positions selected for investigation were the functional (that is, the median occlusal and the right and left lateral) and the retruded (that is, the median retruded and right and left retruded) contact positions.

The mandibular position records were obtained with the gnatho-thesiometer. This apparatus, designed by Posselt at the Royal School of Dentistry in Malmö, Sweden, was devised to register mandibular positions, three-dimensionally, in subjects with teeth. It consists of a movable, inverted model of the mandible with a shaft to represent the condylar axis and a likewise inverted, but fixed, model of the maxilla.

CONCLUSIONS

1. All subjects in both groups seemed to exhibit a retrusive contact range from the median occlusal to the retruded contact position and from the lateral functional to the lateral retrusive contact positions. Group differences, however, could not be discerned.
2. Condylar retrusive movements, from the median occlusal position to the retruded contact position, were often asymmetrical in magnitude and/or direction in subjects of both groups. The greater degree of asymmetry seemed to be exhibited in members of the abnormal group.
3. Movements of the functioning-side condyle, on lateral excursions of the mandible, seemed to vary in magnitude and/or direction for each condyle in the same subject and for each subject of both groups. The more erratic condylar movements seemed to be exhibited by members of the abnormal group.
4. Definite group differences could not be ascertained for any of the various mandibular positions. Gnatho-thesiometric studies on larger groups, however, may indicate group differences more clearly.

News and Notes

American Association of Orthodontists, 1958 Research Section Meeting

Continuing the policy of recent years, one session of the program of the annual meeting will consist of ten-minute oral reports of research. Items submitted for this program by authors not in attendance may be read by title only. All persons engaged in research are urged to present the results of their studies at this session on April 29, 1958. Commodore Hotel, New York, New York.

Each participant is asked to prepare a 250-word abstract for publication in the AMERICAN JOURNAL OF ORTHODONTICS. Both the abstract for publication and the ten-minute oral report should be carefully prepared to present adequately the import of the investigation.

Forms for use in submitting the title and abstract will be sent to each dental school orthodontic department and to any individual requesting one. Please send the title and abstract as early as possible, but not later than Jan. 10, 1958, to Dr. Herbert I. Margolis, Department of Orthodontics, Tufts University School of Dental Medicine, 136 Harrison Ave., Boston 11, Mass.

Thomas D. Speidel, Chairman, Research Committee
School of Dentistry, University of Minnesota
Minneapolis 14, Minnesota

1958 Milo Hellman Research Award, American Association of Orthodontists

The annual prize essay contest of the American Association of Orthodontists is to be known henceforth as the Milo Hellman Research Award, by action of the Association at its 1957 meeting.

Eligibility.—Any member of the American Association of Orthodontists and any person affiliated with a recognized institution in the field of dentistry or associated with it as a teacher, researcher, undergraduate, or graduate student shall be eligible to enter the competition.

Character of Essay.—Each essay submitted must represent an original investigation and contain some new and significant material of value to the art and science of orthodontics.

Prize.—A cash prize of $500.00 is awarded for the essay judged to be the winner. The committee reserves the right to omit the award if, in its judgment, none of the entries is considered to be worthy. Honorable mention is awarded to the authors taking second and third places. The first three papers will become the property of the American Association of Orthodontists and will be published. All other essays will be returned to the authors.

Specifications.—All essays must be in English, typewritten on 8½ by 11 inch white paper, double spaced with at least 1 inch margins. Each sheet must be numbered and bound or assembled firmly in a "brief cover" for easy handling. The title of the essay should appear on the "brief cover." Three complete copies of each essay, including all illustrations, tables, and bibliography, must be submitted. The name and address of the author must not appear on or in the essay. For identification of the essay, its title, its author's name, and a brief biographical sketch setting forth the author's professional training, present activity, and

status (practitioner, teacher, student, research worker) must be typed on a separate sheet of paper and enclosed in a plain envelope. The title of the essay only must appear on the envelope.

Presentation.—The author of the winning essay will be invited to present it at the meeting of the American Association of Orthodontists to be held in New York, New York, April 27 through May 1, 1958.

Judges.—The entries will be judged by the Research Committee of the American Association of Orthodontists.

Final Submission Date.—No essay will be considered for this competition unless received in triplicate on or before Jan. 10, 1958, by Dr. William B. Downs, 314 North Lake St., Aurora, Illinois.

Thomas D. Speidel, Chairman, Research Committee
School of Dentistry, University of Minnesota
Minneapolis 14, Minnesota

American Board of Orthodontics

The next meeting of the American Board of Orthodontics will be held at the Commodore Hotel in New York, New York, April 22 through 26, 1958. Orthodontists who desire to be certified by the Board may obtain application blanks from the Secretary, Dr. Wendell L. Wylie, University of California School of Dentistry, The Medical Center, San Francisco 22, California.

Applications for acceptance at the New York meeting, leading to stipulation of examination requirements for the following year, must be filed before March 1, 1958. To be eligible, an applicant must have been an *active* member of the American Association of Orthodontists for at least two years.

Great Lakes Society of Orthodontists

The twenty-eighth annual meeting of the Great Lakes Society of Orthodontists will be held at the Hotel Statler, Detroit, Michigan, Oct. 20 through 23, 1957.

Orthodontists and students desiring to attend may make reservations directly through the Hotel Statler. Tickets for social functions may be procured from Dr. James Reynolds, Adrian, Michigan.

H. Irving Miller,
Program Chairman

Middle Atlantic Society of Orthodontists

The next annual meeting of the Middle Atlantic Society of Orthodontists will be held at the Warwick Hotel, Philadelphia, Pennsylvania, Oct. 20 through Oct. 22, 1957.

Northeastern Society of Orthodontists

The fall meeting of the Northeastern Society of Orthodontists will be held at the Hotel Statler, Buffalo, New York, Oct. 21 and 22, 1957.

Rocky Mountain Society of Orthodontists

The annual meeting of the Rocky Mountain Society of Orthodontists will be held Nov. 10 to 13, 1957, at Writers Manor in Denver, Colorado. The program will feature papers by Faustin N. Weber, Memphis, Tennessee; Nathan G. Gaston, Monroe, Louisiana; and Bob Meyer, Denver, Colorado.

Southern Society of Orthodontists

The thirty-sixth annual meeting of the Southern Society of Orthodontists will be held at the Eden Rock Hotel, Miami Beach, Florida, Oct. 27 through Oct. 30, 1957. Reservations may be made by writing direct to the hotel.

Oklahoma Orthodontic Society

The annual meeting of the Oklahoma Orthodontic Society was held March 24 and 25, 1957, in the New Student's Union Hotel of the Oklahoma State University (formerly Oklahoma A & M College) in Stillwater, Oklahoma.

After the usual greetings and a pleasant fellowship hour, we were honored by a sumptuous dinner served in the President's Dining Room, comparable to that of the plush hotels.

Following the dinner, President Levern Merrifield opened the evening session with appropriate remarks and took up the study of the report of the Economics Committee, composed of Harry Sorrels, Earl Cunningham, and Marion Flesher. The Committee led a very stimulating round-table discussion based on a questionnaire mailed to the members earlier in the year. This questionnaire covered every phase of handling the business aspect of a case from its beginning to its conclusion and dismissal—including appointments, diagnosis, estimate of length of treatment, primary and secondary, parent-patient-operator relationship, legal and tax aspects, procedure of transfer of patients, collections, etc.

The questionnaire revealed that fees had not kept pace with the cost-of-living index. Of course, all of this study was in the interest of the patient, as it represented an endeavor to render the maximum service to the maximum number of patients. This discussion was so interesting in its importance that it was the wish of the members that the work of the Committee be continued. The lateness of the hour for closing the evening's discussion attested to the interest in the Economics Committee Report.

The program for the Monday morning session comprised the showing of an excellent film on the detailed procedure and the importance of taking a good impression. Carl Strickler presented a new and interesting technique incorporating the use of an elastic removable mouthpiece attached to a headcap or neck strap. Dr. Merrifield demonstrated the use of an activated retaining appliance and the simple technique of a plastic headcap that he is making and using.

Casts of some interesting cases were presented by Hugh Sims, Don Hall, Earl Cunningham, and Levern Merrifield.

The report of the Educational Committee was made by Marion Flesher. A list of the new committee was forwarded to the Secretary of the Board of Governors of Registered Dentists. One phase of the duties of this Committee is to cooperate with the Board of Governors in the examination of candidates for the special practice of orthodontics.

It was voted to forward a letter to the chairman of the State Smile Contest Committee reaffirming our individual and collective support of the Smile Contest in the future.

The newly elected officers are:

President: George Webber, Enid, Oklahoma.
President-elect: Robert Knarr, Tulsa, Oklahoma.
Secretary-Treasurer: George Mindeman, Tulsa, Oklahoma.

More and more our group of orthodontists are enjoying these meetings and round-table discussions. We learn to know each other better, which develops a closer fellowship. Each one has his viewpoint and, while we may not all think alike on all problems, we learn to understand each other and absorb what we can use of the other fellow's ideas.

Through such a channel, discussions cannot help but accrue to the best interests of the patient, the deeper pleasure of a closer fellowship, and the joy of dispensing better service to mankind.

President Levern Merrifield of Ponco City and Secretary Robert Knarr of Tulsa had the program well planned and the facilities well arranged. They are to be complimented for their services in an official capacity.

W. E. F.

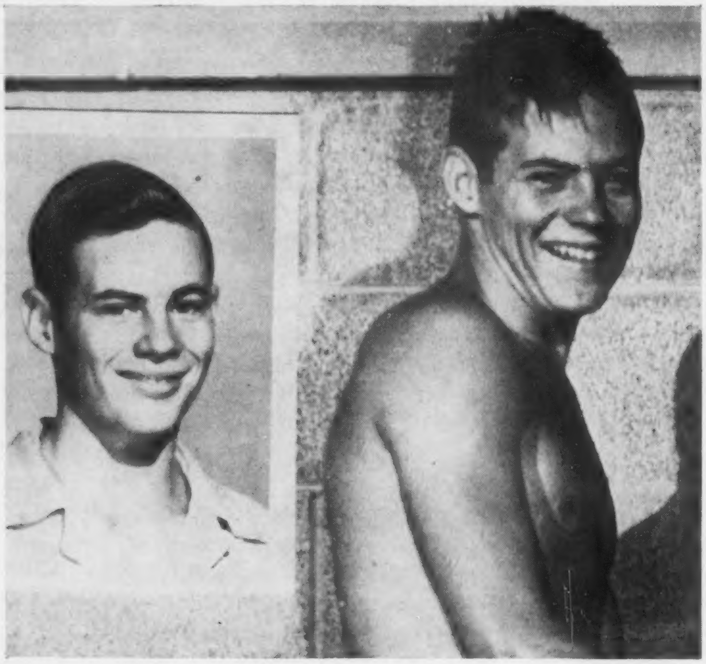
Help Sought in Search for Missing Boy

The following is a letter received from the sheriff of Dade County, Miami, Florida. The letter explains itself and the American Journal of Orthodontics is very happy to cooperate in efforts to locate this young man.

August 29, 1957

Gentlemen:

Enclosed is a photograph and description of dental work done on a missing person by the name of David Disspain, of Miami, Florida. This boy has been missing for six weeks with no clue as to his whereabouts, destination, or reason for his disappearance, and with no evidence of foul play so far uncovered.



David D. Disspain. White male. Age 15 years. Height, 5 feet 8 inches. Weight, 140 pounds. Brown hair and eyes. Husky, good physical condition. Expert competitive swimmer.

Dr. Herman W. Cook, Pan Am Building, Miami, who treated David Disspain, has stated that he will require further adjustment for his dental appliances from time to time. It is anticipated that the boy's appliances will need attention in the near future and such work can be performed only by a qualified orthodontist. Dr. Cook further stated that, due to the nature of the appliances, it is impossible for them to be removed by the boy himself. *Description of dental appliances: Molar bands and anterior bands, with labial arch wire and lingual appliances on upper teeth.*

The Sheriff's Office of Dade County would be greatly indebted to your organization if you would cause a notice to be printed in your publications (*American Journal of Orthodontics* and *Journal of American Dental Association*) requesting that any dentist or member

of the dental society who has occasion to treat anyone answering to the description of David Disspain get in touch with the Sheriff's Department, Criminal Bureau of Investigation, Dade County Courthouse, Miami, Florida.

Yours very truly,
JOHN W. TYLER,
Director

Necrology Committee
American Association of Orthodontists

Please notify the Necrology Committee of the death of any of our members. This information should be sent immediately to the chairman or to any member of the Committee.

Ernest N. Bach, Chairman
305 Professional Bldg.
Toledo, Ohio.

American Dental Association

The ninety-eighth annual session of the American Dental Association will be held in Miami-Miami Beach, Florida, Nov. 4 to 7, 1957.

National Association of Dental Laboratories

William Alstadt, president-elect of the American Dental Association, and Kenneth Brasted, president of the University of Dallas, will be featured speakers at the seventh annual meeting of the National Association of Dental Laboratories in Dallas, Texas, Oct. 17 to 20, 1957. Dr. Alstadt will speak at the Lone Star luncheon on October 18 and Dr. Brasted at the Big D luncheon on October 19.

Notes of Interest

Dr. Saul N. Greenberg, 146-17 Northern Blvd., Flushing, New York, announces the opening of his Port Washington office at 22 Evelyn Rd., practice limited to orthodontics.

Arthur L. Seiler, B.S., M.S., D.M.D., announces his return from active military service and the resumption of his practice at 978 Colvin Ave., Kenmore, New York, practice limited to orthodontics.

A. G. Wicks, D.D.S., and Robert G. Wicks, B.S., D.D.S., M.S., announce the association of Walter F. Hampe, B.S., D.D.S., M.S., 666 Washington Rd., Mt. Lebanon, Pennsylvania, practice limited to orthodontics.

Forthcoming meetings of the American Association of Orthodontists:
1958—Commodore Hotel, New York, New York, April 27 to May 1.
1959—Statler Hotel, Detroit, Michigan, May 4 to 7.
1960—Shoreham Hotel, Washington, D. C., April 24 to 28.
1961—Denver, Colorado.
1962—Los Angeles, California.

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Central Section of the American Association of Orthodontists
(Next meeting Sept. 23-24, 1957, Minneapolis)

President, Thomas D. Speidel - - - - - - - - University of Minnesota Dental School, Minneapolis, Minn.
Secretary-Treasurer, William F. Ford - - - - - - - 575 Lincoln Ave., Winnetka, Ill.

Great Lakes Society of Orthodontists
(Next meeting Oct. 20-23, 1957, Detroit)

President, Harlow L. Shehan - - - - - - 601 Jackson City Bank Bldg., Jackson, Mich.
Treasurer, Russell E. Huber - - - - - - - 350 Fidelity Medical Bldg., Dayton, Ohio
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Middle Atlantic Society of Orthodontists
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President, Aubrey P. Sager - - - - - - - 1210 Medical Arts Bldg., Philadelphia, Pa.
Secretary-Treasurer, Paul A. Deems - - - - - - - - - 835 Park Ave., Baltimore, Md.

Northeastern Society of Orthodontists
(Next meeting Oct. 21-22, 1957, Buffalo)

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Pacific Coast Society of Orthodontists
(Next meeting Feb. 23-27, 1958, Santa Barbara)

President, A. Frank Heimlich - - - - - - - - 1824 State St., Santa Barbara, Calif.
Secretary-Treasurer, Raymond M. Curtner - - - - 450 Sutter St., San Francisco, Calif.
Director, A. Frank Heimlich - - - - - - - - - 1824 State St., Santa Barbara, Calif.

Rocky Mountain Society of Orthodontists
(Next meeting Nov. 11-13, 1957, Denver)

President, J. Lyndon Carman - - - - - - - - - 501 Republic Bldg., Denver, Colo.
Secretary-Treasurer, H. Carlyle Pollock, Jr. - - - - 1558 Humboldt St., Denver, Colo.
Director, J. Lyndon Carman - - - - - - - - - - 501 Republic Bldg., Denver, Colo.

Southern Society of Orthodontists
(Next meeting Oct. 27-30, 1957, Miami Beach)

President, Frank P. Bowyer - - - - - - - 608 Medical Arts Bldg., Knoxville, Tenn.
Secretary-Treasurer, H. K. Terry - - - - - - - - 2742 Biscayne Blvd., Miami, Fla.
Director, Edgar Baker - - - - - - - - - - - - Professional Bldg., Raleigh, N. C.

Southwestern Society of Orthodontists
(Next meeting Sept. 29–Oct. 2, 1957, Dallas)

President, Tom M. Williams - - - - - - - - 612 Medical Arts Bldg., Dallas, Texas
Secretary-Treasurer, Harold S. Born - - - - - - - 908 S. Johnstone, Bartlesville, Okla.

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AMERICAN JOURNAL OF ORTHODONTICS

Published by THE C. V. MOSBY COMPANY, 3207 Washington Blvd.
St. Louis 3, U. S. A.

Entered at the Post Office at St. Louis, Mo., as Second-class Matter

Published Monthly. Subscriptions may begin at any time.

Official Publication of The American Association of Orthodontists, its component societies and The American Board of Orthodontics

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